CHAPTER 3.2

Geomorphology, Hydrology, and Water Quality

This Chapter discusses the existing environment of the Scott River watershed (Program Area); identifies potential impact on geomorphology, hydrology, and water quality in the Scott Valley related to the Scott River Watershed-wide Permitting Program (Program); and proposes mitigation measures for those impacts determined to be significant. Information on the environmental setting in this Chapter was compiled from: field reconnaissance of the Scott River watershed (Program Area); review of various reports and studies provided by the California Department of Fish and Game (CDFG) and the Siskiyou Resource Conservation District (SQRCD); peer-reviewed scientific literature; and federal and state resource agency websites, databases, and reports.

3.2.1 Environmental Setting

Regional Setting – The Klamath River Basin

The Scott River is a sizeable tributary within the larger Klamath River basin. The Klamath River originates in south-central Oregon, east of the Cascade Mountain Range. The 263-mile river flows in a general southwesterly direction through Oregon into California. In California, the Klamath River continues flowing southwesterly before turning northwesterly near its confluence with the Trinity River and continuing to the Pacific Ocean. The Klamath River drains about 15,600 square miles (of which 3,600 square miles are considered non-contributing) in California and Oregon, and is California's second largest river system (Ayres and Associates, 1999; CDFG 2002a in CDFG, 2004).

Much of the natural flow in the Klamath River basin is regulated. Four hydroelectric facilities and two other diversion and regulation dams on the mainstem system, as well as numerous public and private water diversion projects, regulate and alter the flow of the river. In the upper Klamath River basin (upstream of Keno Reservoir), a large volume of water is stored and then diverted for agricultural purposes during the spring-summer growing season by private diverters and the U.S. Bureau of Reclamation's (USBR) Klamath Project (CDFG, 2004). The Klamath Project impounds water at Upper Klamath Lake. Substantial water diversion and water use also occur in other areas of the Klamath River basin. Department of Water Resources (DWR) estimated that current annual agricultural water use in the Program Area totals 71,800 acre-feet (DWR, 1997 in CDFG, 2004). In comparison, average annual irrigation and urban water use above Keno Dam in Oregon totals 503,700 acre-feet (DWR, 1997 in CDFG, 2004).

Scott River Watershed

The Program Area comprises the entire Scott River watershed, which is located in Siskiyou County in central-northern California. The Program Area lies within the Klamath Mountains geomorphic province and it is approximately 812 square miles in extent. Geomorphic provinces are naturally defined geologic regions that display a distinct landscape or landform; eleven provinces are distinguished in California (CGS, 2002) with each region displaying unique, defining features based on geology, faults, topographic relief and climate. Though within a single province, the Scott River watershed is a large area with substantial variation in geology, geomorphology, and climatology (SRWC, 2006).

The Scott River is one of four major tributaries of the Klamath River, entering the Klamath at River Mile (RM) 143 and at an elevation of 1,580 feet above mean sea level (amsl). The Scott River is fed by a number of tributaries, many of which run dry or exhibit sub-surface flow conditions in the summer months. It is estimated that there are over 700 miles of streams within the basin (Deas and Tanaka, 2004). The (mainstem) Scott River is approximately 58 miles long and its primary tributaries and sub-basins include: the East Fork of the Scott River, the South Fork of the Scott River, Wildcat Creek, Sugar Creek, French Creek, Etna Creek, Patterson Creek, Kidder Creek (including Big Slough), Shackleford Creek (including Mill Creek), and Moffett Creek.

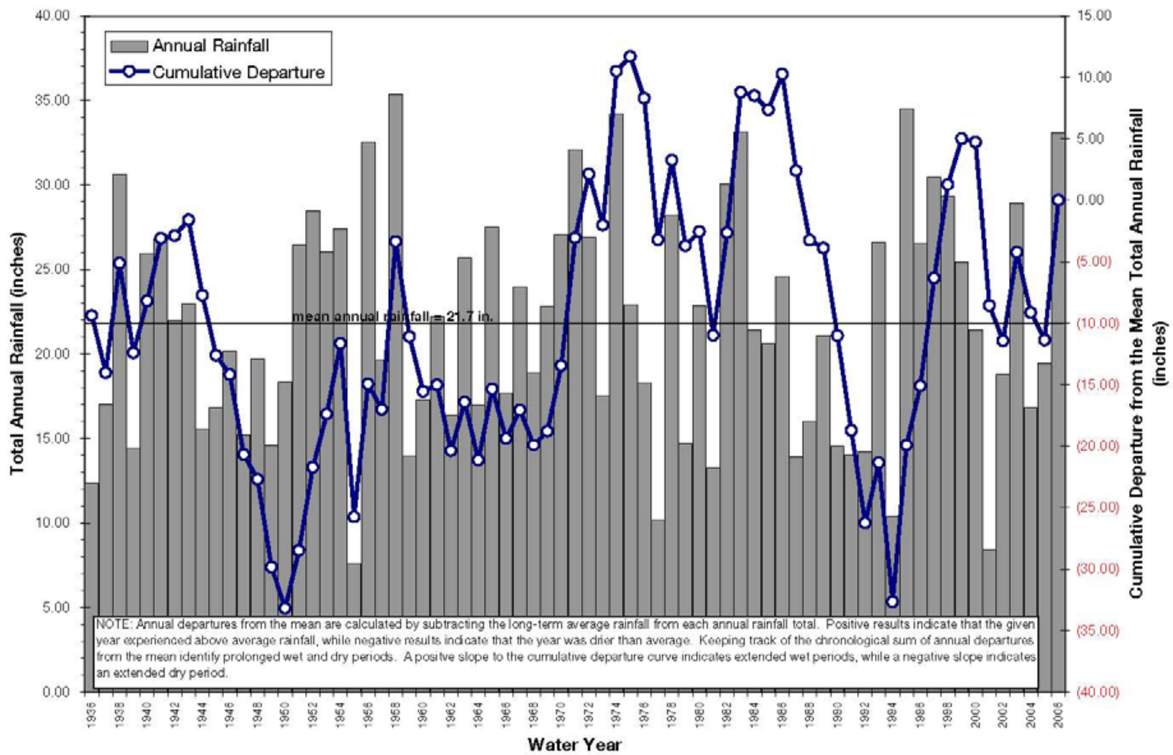
The headwaters of the East Fork of the Scott River rise on China Mountain, about 6.5 miles northeast of Callahan; the source of the South Fork of the Scott River lies in the mountain lakes about 4.5 miles southwest of Callahan. Below their confluence, the Scott River meanders through an open agricultural valley (the Scott Valley) and then descends into a canyon carved along the eastern edge of the Marble Mountains before reaching the Klamath River.

Climate and Precipitation

The Program Area is dominated by a Mediterranean climate characterized by warm, dry summers and cold, wet winters. Precipitation is mainly concentrated in the winter months and falls primarily as rainfall on the Valley floor, while significant snowfall occurs on the surrounding mountain ranges resulting in snowmelt runoff during the early spring months (Deas and Tanaka, 2006). Average annual precipitation for the entire area is about 36 inches, yet annual rainfall, snowfall, and temperature can vary widely from one year to the next and from one part of the watershed to another. The annual rainfall trend recorded at Fort Jones (WRCC, 2006) from water year[1] (WY) 1936 to 2006 is shown in **Figure 3.2-1**.

In large part, the orientation and topography of the Program Area control the influence of precipitation. Most of the precipitation in the Program Area falls on the west side, with snow prevailing above the 5,500 foot level during the winter (SRWC, 2006). The Program Area slopes north-northwestward, draining to the Klamath River. The Valley floor lies between altitudes of 2,700 and 3,000 feet amsl and the mountains to the west, south, southwest and northwest

[1] A Water Year begins on October 1 of the previous year and ends on September 30 of the designated Water Year. For example, Water Year 2004 comprises October 1, 2003 through September 30, 2004.



SOURCE: CDEC (2006); ESA

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Figure 3.2-1
Annual Precipitation at Fort Jones, CA
(Water Years 1936-2006)

(Marble, Salmon, Trinity Alps and the Scott Bar Mountains) rise noticeably higher than those to the east. From the edge of the Valley, the western mountains rise abruptly to 8,000 to 8,500 feet amsl. These ranges exert a strong orographic effect on incoming storms, which allows the higher elevation mountains (along the west and south), to receive 60 to 80 inches of precipitation annually. In contrast, the rain shadow effect of the mountains to the west reduces the amount of annual precipitation to 12 to 15 inches on the east side of the watershed (SRWC, 2006). About 75 to 80 percent of the precipitation occurs from October through March, with occasional thunderstorms during summer months.

Geology

The geology of the Program Area is a complex of several geologic terranes and many identified formations and rock types (Mack, 1958; USDA, 2000; North Coast Regional Water Quality Control Board (NCRWQCB), 2005). The geologic material and structure underlying various sub-watersheds of the Program Area is a primary factor in determining the nature and magnitude of geomorphic processes and sediment delivery under natural conditions, as well as sediment delivery in response to human activities. In regards to hillslope process and erosion rates, the various geologic bedrock lithologies can be aggregated into four similarly behaving units (NCRWQCB, 2005):

- Granitic Bedrock
- Mafic and Ultramafic Bedrock
- Sedimentary and Metamorphic Bedrock
- Quaternary Age Deposits (1.8 million years ago (Ma) to the present)

A significant portion of the Program Area (10.6 percent) is underlain by various types of granitic bedrock, exposed primarily in the mountains paralleling the west side of the Scott Valley. These bedrock types are largely confined to the western side of the watershed (Sommarstrom, et al., 1990). The suite of granitic rocks ranges in composition from granite to granodiorite (Mack, 1958), is generally fine grained, and weathers to noncohesive and highly erodible soil. Granitic soils produce sediment through a significantly different balance of processes than the other bedrock units. Where weathering is severe, the “decomposed” granitic soils are highly susceptible to dry ravel, rill and gully erosion, debris slides, and debris torrents (Kellogg, 1992). Soil erosion and fluvial transport in disturbed areas (e.g., burned landscapes) are the most common sediment transport and delivery processes in areas of decomposed granitic soils. In addition, disturbance of the surface or an increase in the degree of slope tends to accelerate these processes.

Mafic and ultramafic rocks occur in parts of the Marble Mountains in the northwest part of the watershed, in the Scott Mountains in the southeast, and in a disconnected belt that runs from the south part of the Scott River watershed to the northeast part (NCRWQCB, 2005). Mafic and ultramafic rocks typically consist of serpentine along with minor basalt, peridotite, and gabbro (Jennings, 1977) inclusions. Much of the area underlain by mafic and ultramafic rocks consists of steep mountains where the bedrock is locally sheared. These rocks weather to form soil that is finer-grained and more clay-rich than soil formed on granitic rocks; the result is a lower tendency toward dry ravel, sheetwash, and rillwash (because of its comparative cohesion). Some limited areas of sheared bedrock are vulnerable to landsliding (NCRWQCB, 2005).

Sedimentary and metamorphic bedrock, mostly of Mesozoic age (250 to 65 Ma), underlies more than half of the Program Area. The sedimentary rocks comprise many lithologies. The metamorphic rocks include amphibolite, greenschist, blueschist, and metavolcanics (including some Tertiary age [65 to 1.8 Ma] metavolcanics) (Wagner and Saucedo, 1987). Although these suites of sedimentary and metamorphic rocks vary in geomorphic expression and potential for sediment contribution, in general there is more in common between them in terms of soils formed, structural strength, and slope stability compared to the granitic or mafic rocks.

Quaternary sedimentary deposits consist of unconsolidated gravel, sand, and soil that make up the floor of the Scott Valley and the lower reaches of some tributary valleys, as well as the alluvial and colluvial deposits along the margins of the valleys. Alluvial and colluvial deposits are accumulations of sediment transported from upstream or upslope areas, respectively. Small areas within this unit include glacial deposits in the high valleys of the Scott Mountains and landslide deposits. Erosion processes are typically limited to minor mass wasting of colluvial deposits on steep side slopes or upland areas and fluvial processes (bank erosion and gullying) within valley bottom locations.

The western mountains rising from the Scott River Valley climb more steeply and to higher elevations than do the mountains east of the valley. Geologically recent, high rates of uplift have produced steep mountains that shed abundant sediment to the valley floor. Sediment deposited by streams emanating from the comparatively steep tributaries west of the mainstem Scott River valley has been built up into a series of distinct, steeply sloping coalescing alluvial fans (Mack, 1958). The western slope thus developed is in marked contrast to the more subdued topography characteristic of the Valley floor at the foot of the eastern mountains.

Generally speaking, soils within the Program Area have developed on floodplains, alluvial fans, and mountain slopes. Floodplain soils are very deep, nearly level to gently sloping, and poorly drained to somewhat poorly drained loams. They are formed from medium-textured to moderately fine-textured alluvium derived from mixed rock sources (USDA, 1983). Bank erosion is the most common natural process generating and delivering sediment in the floodplain of the mainstem Scott River and its low gradient tributaries.

Soils formed on alluvial fans are very deep, nearly level to strongly sloping, well drained, gravelly sandy loams and are found along the streams that drain into Scott Valley (USDA, 1983). They have formed in moderately coarse textured to medium textured alluvium derived from the mixed rock sources of their tributary source areas. Alluvial fans are depositional features that form at the base of low order, steep tributary streams that flow onto low gradient alluvial deposits of the mainstem and tributary valleys. Each of the main tributaries then emerges from the mountain front in broad alluvial fans that extend out into the main portion of the Scott River Valley.

Soils that develop on steep slopes of the surrounding Klamath Mountains range from very shallow to very deep and are well drained to excessively-drained with medium textured to moderately coarse textures. Upland soils are typically subject to erosional processes, and their susceptibility to erosion is highly correlated to bedrock composition. Soils developed on coherent metamorphic rocks of the lower watershed are more prone to mass wasting processes (USDA, 2000). In contrast, soils derived from granitic parent material in the western tributaries are noncohesive and usually highly erodible. About 56,900 acres of granitic soils are found in the Scott River watershed, mainly on the south and west sides of Scott Valley (Sommarstrom et al., 1990).

Sediment Supply

Watershed-wide soil erosion, mass wasting, and sediment delivery rates are influenced by climate (precipitation type, magnitude, and intensity), geologic materials, soil characteristics (depth and erodibility), and hillslope gradient. Landsliding is relatively common in the lower northwestern portion of the watershed and comparatively uncommon in eastern tributaries. Surface erosion and bank erosion are dominant erosional processes in areas of highly erodible granitic soils of the western and southwestern watershed. Landsliding occurs episodically in response to large storms and produces large volumes of sediment in single pulses. Intense storms with a return period of 10 to 20 years (or more) can produce huge increments of sediment in a matter of a few hours (USDA, 2000).

Steep mountain terrain that experiences periods of intense rainfall is subject to landsliding and surface erosion. Slope steepness is often correlated with landslide risk. The steepest slopes in the Program Area are predominately located along the western side of the watershed, with the steepest hillslopes in the northwestern part of the basin. The lower half of the Program Area is within the Western Paleozoic and Triassic belt of the Klamath Mountains province. This part of the watershed consists of steep and rugged terrain. The Scott River Canyon cuts through these mountains. Slopes with greater steepness generally have a higher frequency of mass wasting, and this is borne out by mapping of landslides visible on historic aerial photos (**Figure 3.2-2**) (NCRWQCB, 2005).

Granitic terrain of the western portions of the middle and upper watershed typically has fewer landslides than occur in the metamorphic rocks. This geomorphic terrane typically has few large landslide deposits, some small debris slides, and high rates of surface soil erosion. The bedrock geology of the lower watershed consists of metamorphic rocks that have been intruded by granitic and ultramafic rocks. Landslides become increasingly more common in the steeplands of the lower Scott River watershed (USDA, 2000).

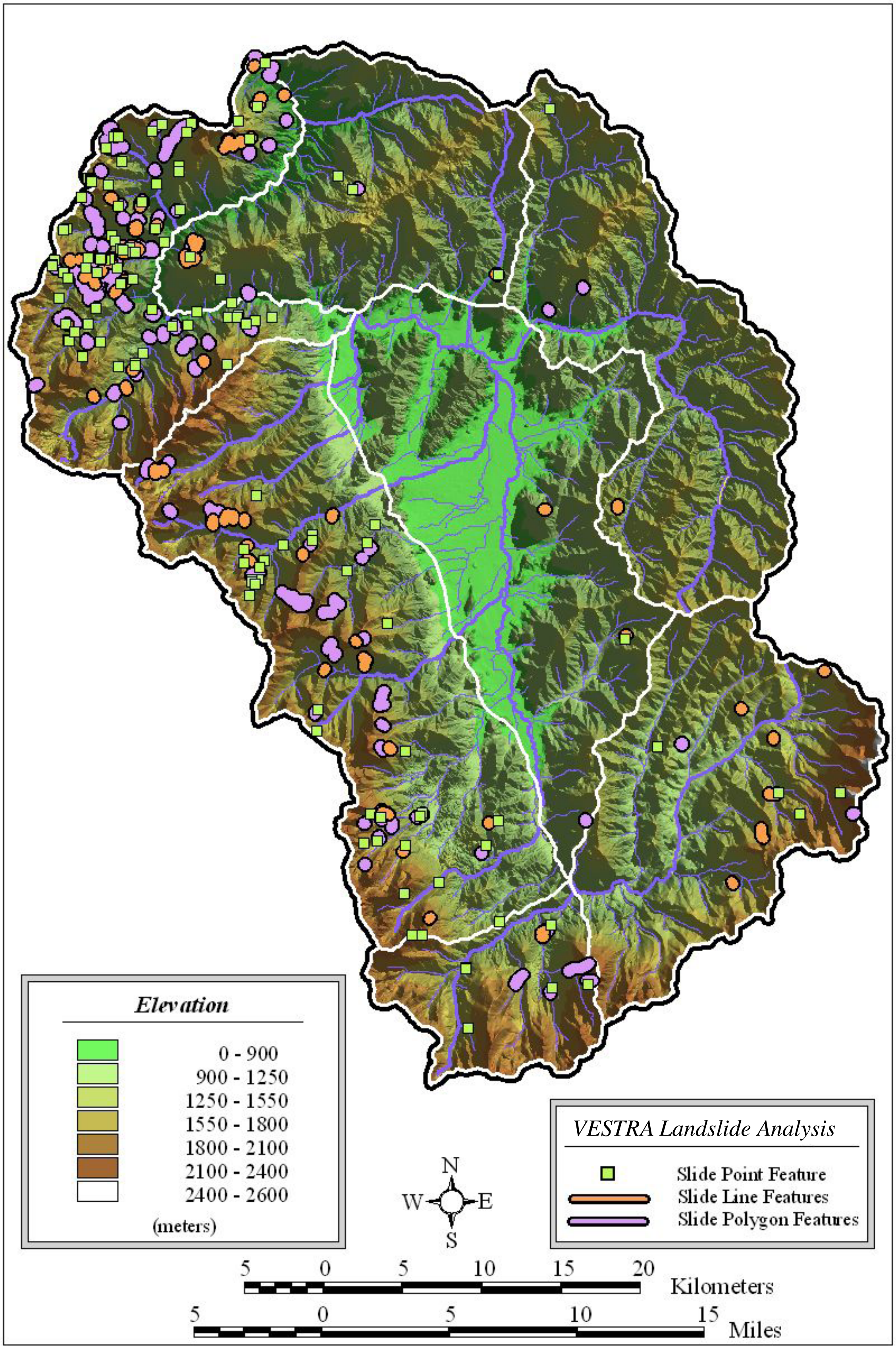
Most mass wasting consists of shallow debris slides and occasional debris flows that are triggered by intense rain or rain-on-snow storm events. Debris flows travel down steep tributary stream channels and have lasting effects on depositional zone channel morphology (SRWC, 2004). Slumps, earthflows, and large rotational slides are not important processes in Scott River granitics or elsewhere in granitic terrain (Megahan, 1974; Baldwin and De la Fuente, 1987; as cited in Sommarstrom et al., 1990). In spite of the occurrence of mass wasting, especially during large storm events, landslides are not a dominant source of sediment in the streams in most of the Scott River watershed (NCRWQCB, 2005).

In the eastern tributary watersheds (including Moffett Creek) fluvial erosion processes, including gullying and bank erosion, predominate (SHN, 2003). Steepland channels deliver sediment to low gradient valley bottoms where long term accumulations typically form alluvial fans along the margins of the valley. Mass wasting is uncommon (NCRWQCB, 2005). The mainstem Scott River in the lower gradient section of the valley is dominated by channel shifting, bank erosion, and downcutting. However, channel straightening, levee construction, bank armoring, and past mining has limited channel changes along many sections of the mainstem (Sommarstrom et al., 1990).

Historic Morphology and Flooding

During the early evolution of the Scott River, it was an actively degrading stream which was downcutting in response to intermittent regional uplift (Sommarstrom et al., 1990). Former ridges in the Valley between the western tributaries were eroded and the morphology of the channels gradually changed. Eventually, the Scott River and its tributaries began to aggrade their courses and the main channel migrated to the east side of the valley

Historic accounts, as far back as the mid 1800s, suggest that the Scott River through the Valley was at one time narrower and deeper, on average, compared to today. In May of 1855, one observer described the Scott River in the Valley as from 30 to 40 yards in width and deep in



SOURCE: NCRWQCB (2005)

Figure 3.2-2
Scott River Watershed Landslides

many places (Metlar, 1856, in Sommarstrom et al., 1990). Today the Scott River is hundreds of feet wide in many of the Valley reaches. This process of channel widening has been influenced by both human actions (described below) and natural processes (such as flooding).

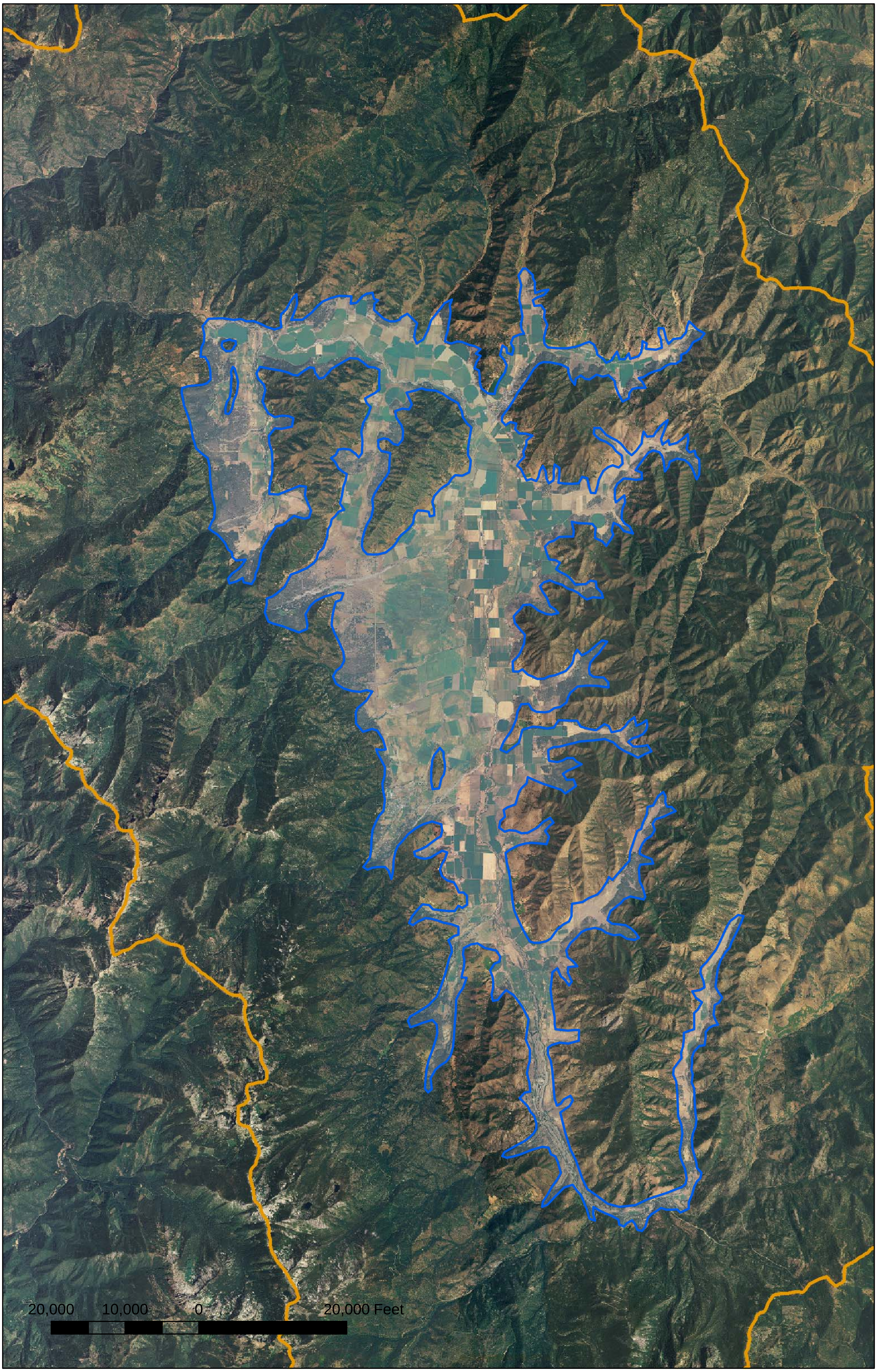
Like many large river basins, major floods have had a profound impact on past and present conditions within the Program Area. Before the turn of the twentieth century, major floods were recorded in 1852-53, 1861, 1864, 1875, and 1880; Wells (1881, in Sommarstrom et al., 1990) noted that these floods swept the rivers clear of mining improvements that existed during that time. Prior to the period of record at the U.S. Geological Survey (USGS) station, the flood of 1861 appears to have been the largest event mentioned in historical accounts. The 1861 flood, in combination with mining debris, caused the upper Scott River to alter its course from the west side to the east side of the Valley downstream of Callahan (Jackson, 1963, in Sommarstrom et al., 1990).

During this past century, large floods also occurred in 1955, 1964, and 1997. The large winter floods of 1955 and 1964 had a profound effect on the morphology and character of the Scott River. Much of the sediment delivered to the Scott River in the 1955 and 1964 floods was eventually deposited on the wide Valley floor; 6,300 and 26,520 acres were inundated in 1955 and 1964, respectively (Sommarstrom et al., 1990). From geological and botanical evidence in the Scott River Canyon, Helley and LaMarche (1973, in Sommarstrom et al., 1990) determined that the 1861 and 1955 floods were of equal magnitude though less severe than the 1964 flood. Sediment deposition during flooding led to aggradation of the streambed in some areas and large amounts of sediment were eroded from banks that offered little resistance due to the lack of stabilizing riparian vegetation. The net result (including the influence of U.S. Army Corps of Engineers [USACE] projects in the 1930s) for the Scott River is now a wide (up to 300 feet), shallow channel with almost no vegetative cover in the Valley (Quigley et al., 2001).

The Federal Emergency Management Agency (FEMA) is responsible for mapping areas subject to flooding during a 100-year flood event (i.e., one percent chance of occurring in a given year). According to FEMA (2004), several lowland areas in the Program Area are located within the 100-year floodplain. The widest area of the 100-year floodplain (about 3.5 to 4 miles) is in the vicinity of Big Slough, and lies mostly to the west of the mainstem Scott River. Other notable FEMA floodplain areas include the lower reaches of Moffett Creek, Etna Creek, and French Creek.

Regional Groundwater Hydrology

The principal groundwater feature in the Program Area is the Scott River Valley Groundwater Basin (Groundwater Basin) (**Figure 3.2-3**). The Groundwater Basin underlies the alluvial floodplain and is approximately 28 miles long, 0.5 to 4 miles wide, and nearly 100 square miles in surface extent (DWR, 2004). Within the Groundwater Basin, Quaternary stream channel, floodplain, and alluvial fan deposits are the primary water-bearing formations. Groundwater storage capacity of the basin (to a depth of 100 feet) is estimated to be 400,000 acre-feet (Mack, 1958). This large aquifer is recharged annually by the Scott River, tributary streams, and by infiltration of precipitation and snow melt.



SOURCE: DWR (2004)

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Figure 3.2-3
Scott River Valley Groundwater Basin

In the Valley, groundwater exerts strong influence on the volume and quality (i.e., temperature) of Scott River flow. The seasonal fluctuation of the groundwater table locally determines whether portions of the Scott River are being supplied by groundwater ("gaining stream") or are infiltrating surface flow into the groundwater aquifer ("losing stream"). During the winter and spring the aquifer is recharged by the river and percolated precipitation. Once river flow subsides, the river typically changes to a gaining stream as stored groundwater enters the stream channel. In drier years, winter and spring flows are not sufficient to fully recharge the Scott River Valley Groundwater Basin, the water table falls below the elevation of the channel bed, and the river goes dry (NCRWQCB, 2005).

Human Influence on Hydrologic and Geomorphic Processes

Human settlement and land management activities have had a measurable and lasting effect on the natural hydrologic and geomorphic processes within the Program Area. Hence, what is seen today in the Program Area is quite different from 150 years ago. In terms of their effect on watershed processes, these activities can be divided into upland management activities that produce downslope and downstream impacts, and valley bottom and stream channel management activities that more directly affect the geomorphology of the main river system. The most important changes and land management actions include: timber harvesting and road construction, fire suppression, beaver removal, mining and dredging operations, channel modification and flood control, and agricultural practices.

Upland Management

The Scott River, and the Scott River Valley, have been subject to human alteration since the 1800s. Hillslope processes have been altered over the past century by the effects of hydraulic mining, road and skid trail construction, and vegetation removal by fires, fire suppression, grazing, and timber harvest (SRWC, 2004). In the upland areas, the steep mountainous terrain areas are naturally susceptible to landslides, but the size and frequency appears to have increased in certain geologic terranes[2] due to impacts from the combination of locally severe fires, regional flood events, intensive timber harvest, and road construction on steeper slopes (USDA, 2000; NCRWQCB, 2005). Roads were not extensively constructed in the steeper regions until the 1950s by the U.S. Forest Service (USFS), but construction increased rapidly on both private and public lands in the following decades (SRWC, 2004). Upslope forest management has had an effect on downstream channel systems largely through altered hydrology and increased watershed erosion and sedimentation.

Timber Harvesting and Road Construction

Timber was originally needed for settlement and early mining operations in the Scott River Valley. By 1880 there were 11 saw mills operating up and down the Valley (Sommarstrom et al., 1990). Logging increased after World War II and was accompanied by the construction of hundreds of miles of logging roads and skid trails on both private and public lands. Many studies

[2] A terrane, in paleogeography, is a crustal block that preserves a distinct geologic history different from surrounding areas.

on all soil types identify road construction as the largest single source of accelerated erosion and landsliding and resultant stream channel sedimentation in steepland forest environments.

Logging on steep slopes in the Scott River watershed has accelerated landslide activity and sediment delivery to streams (USDA, 2000; NCRWQCB, 2005), particularly in the steeper western and northwestern portions of the watershed. Logging and road construction have also dramatically increased erosion rates and sediment delivery to streams in westside watersheds underlain by highly erodible granitic soils (Sommarstrom et al., 1990; NCRWQCB, 2005). Flood events trigger landslides, and most of the catastrophic landslides during storms of record occurred on steep slopes that had previously been timber harvested and/or burned during the 1987 fires in the lower watershed (USDA, 2000; NCRWQCB, 2005). The 1964 flood event and the more recent January 1997 flood, a 25-year event, had a considerable affect on the lower watershed and in westside tributaries, and it contributed large amounts of sediment to streams due to landslides, plugged culverts, and road failures from poor road design and recent forest fires (De la Fuente and Elder, 1998; USDA, 2000). Overall, mass wasting is estimated to range from 0 to 275 percent over natural rates in the lower Scott River watershed; similarly, surface erosion has been estimated to range from 0 to 790 percent above natural levels in watersheds of the lower Scott River (USDA, 2000).

Roads and severe winter storms often combine to produce large pulses of sediment into the stream channel system of the Program Area. The average overall road density (for all road types) for the lower watershed (including both National Forest and private lands) is 2.9 miles per square mile, excluding Wilderness Areas (USDA, 2000). On private timber lands in the upper watershed, adjacent to the Scott River Valley, road densities are much higher, reaching approximately 8.9 miles per square mile in the Shackleford and Mill Creek watersheds (SHN, 1999).

The watershed’s decomposed granitic soils are particularly susceptible to land use disturbances, especially timber harvesting and road construction. By 1989, 66 percent of the private timberlands (since 1974) and 34 percent of the public timberlands (since 1958) on these erodible soils had been harvested in the Scott River watershed (Sommarstrom et al., 1990). The 1990 Scott River Basin Granitic Sediment Study concluded that about 60 percent of the average annual sediment yield from granitic soils in the watershed was due to management activities, with the balance being the natural background level (Sommarstrom et al., 1990).

Land management has greatly accelerated sediment production and delivery from granitic areas (**Table 3.2-1**). The granitic sediment study evaluated the 57,000 acres of granitic soils contributing to the Program Area. It was estimated that sediment was derived from a number of management-related sources, including: road cuts (40 percent), streambanks (23 percent), road fills (21 percent), skid trails (13 percent), and the balance (3 percent) from road surfaces, landslides, and dispersed sources of sheet and rill erosion (Sommarstrom et al., 1990). Overall, road-related sediment sources contributed 63 percent of the total estimated sediment yield. The French Creek watershed was identified as the largest single watershed contributor of fine grain granitic sediment to the Scott River watershed, representing 23 percent of the total yield. Of the average yield of 71,500 tons of decomposed granitic sediment estimated to be delivered to the

TABLE 3.2-1
SCOTT RIVER WATERSHED SEDIMENT SOURCE SUMMARY USED FOR TMDL
(TABLE 3.22; NCRWQCB, 2005)

Sediment Delivery Summary, by Locality	Total Natural Delivery – all sources (tons/sq mi-year)	Total Human-Activity Related Delivery – all sources (tons/sq mi-year)	Total Delivery (tons/sq mi-year)	Percentage Above natural
West Canyon (lower basin)	544	487	1031	90%
East Canyon (lower basin)	511	242	754	47%
Eastside (Moffett Creek)	491	218	709	44%
East Headwaters (East Fork)	377	314	691	83%
West Headwaters (South Fork)	602	343	945	57%
Westside Tributaries	518	269	786	52%
Scott Valley	239	293	533	123%
Watershed Weighted Average	**447**	**299**	**746**	**67%**

Scott River each year, 60 percent of the sediment was attributed to management sources (Sommarstrom, et al., 1990; based on 1989 data). Sand-sized and finer sediment has accumulated in the middle of the Scott River Valley and produced wide, shallow channel conditions with few pools (Sommarstrom et al., 1990).

Increased sediment delivery to streams has impacted channel morphology by filling pools and the interstitial spaces in gravels with fine sediments in streambeds of both the tributaries as well as the mainstem Scott River (SQRCD, 2005). These fine sediments accumulate in low gradient channel reaches until flood flows transport the sediment in large pulses to lower basin areas and the main channel of the Scott River. Channel aggradation then contributes to increased bank erosion in a self-sustaining process. Increased sedimentation on the tributary alluvial fans along the Valley margin has also caused the distributary channels to become wider and shallower. Aggraded tributary channels flood more frequently and low summer flows are less likely to remain hydrologically connected to the river mainstem.

Present day river processes are a combined product of past and present watershed and riverine disturbances, modified streamflow regimes, and an accelerated supply of sand size sediment (0.0625 millimeters (mm) to two mm) from the adjacent tributary watersheds. Most sediment that is delivered to stream channels in the Scott River watershed is derived from episodic small scale erosion features occurring along stream channels (e.g., bank erosion and small slides) (NCRWQCB, 2005). Sixty-five to 70 percent of both natural and man-caused sediment delivery comes from these sediment sources. In contrast, watershed-wide, roads and landslides produce approximately 10 and seven percent of total sediment delivery (NCRWQCB, 2005) (though some of this sediment delivery from roads and landslides is accounted for in the aforementioned 65 to 70 percent). The majority of the past and potential management induced sediment yield to Moffett Creek, the main eastside tributary, is also associated with bank erosion and incision occurring along tributary stream channels. This type of erosion accounts for approximately 95 percent of the total management-induced sediment contribution to Moffett Creek and is followed to a much lesser extent by sheet wash and gully erosion occurring along roads and on upland slopes (SHN, 2003).

In the main Valley section, the Scott River is essentially a low gradient sand bed river. Excessive sand in the river was not noted by CDFG until about 1948 (SRWC, 2004). Unstable granitic soils and past human activities along the western slopes and watersheds of Scott Valley have contributed significantly to the excessive fine sediment found in the Scott River and certain tributaries (Sommarstrom et al., 1990). Periodic floods tend to move sediment into and through the steeper portion of the fluvial system and deposit sediment on the floodplain and in the valley-bottom streambeds of the lower main tributaries and the mainstem. This has resulted in accelerated stream bank erosion in lower gradient channel reaches (SRWC, 2004) and altered channel function. Much of the sediment delivered to the Scott River in the 1955, 1964, and 1997 floods was eventually deposited on the wide Valley floor (Sommarstrom, 1990). Alluvial floodplains can serve as temporary or long-term storage (Beschta, 1987, as cited in Sommarstrom, 1990). These deposits are still being removed. Another important storage area is the "Big Slough," which parallels the Scott River and drains the tributaries north of Etna Creek (Johnson, Crystal, Patterson Creeks) (Sommarstrom, 1990). This is considered a long term storage sink for sediment delivered from the contributing sub-watersheds.

Fire Suppression

Wildfire is one of the triggers for generating high rates of surface erosion in areas with decomposed granitic soils. Throughout the west, decades of fire suppression have increased the susceptibility and potential magnitude of wildfire in forested landscapes. Although large lightning-caused fires are fairly frequent in the Klamath Mountains, extensive fires are not common in the study area as little volatile brush is present on the west side of the Scott Valley (Sommarstrom et al., 1990). By far the largest fire of record was the 1955 Kidder Creek fire, which occurred only a few months before the disastrous December, 1955 flood. The relationship between 1955 flood magnitude, watershed erosion rates, stream channel sedimentation, and the wildfire has not been reported. Intense wildfire over large portions of the lower Scott River watershed in 1987 was followed by severe landsliding during the 1997 flood event (USDA, 2000).

Valley Bottom and Stream Channel Management

The Scott River is not a pristinely functioning geomorphic system. Stream channels in the Program Area, especially in the lower gradient alluvial fan and valley bottom sections, have been modified almost since first occupation of the watershed. Through legacy effects as well as existing practices, activities such as beaver trapping, alluvial gold dredging, river straightening, bank protection, levee construction, streamflow manipulations, and upland land management continue to dominate the geomorphic function of the Scott River and a number of its main tributaries. Channel alterations began in the 1830s with the removal of most of the beaver population in Scott Valley and the East Fork (Sommarstrom et al., 1990). This caused local channel incision and simplification of channel morphology.

Beaver Removal

One of the earliest noted events related to impacts to the natural hydrology of the Program Area was the trapping and removal of beaver, beginning in the 1830s. While not all of the beaver were taken, this major removal likely had a significant effect on the Scott River and its tributaries. Beaver dams add complexity to stream habitat. These dams create ponds that act as sediment traps, gradually filling to create swamp or meadow environments, similar to that described by trappers working in the Scott River Valley in the early 1800s. The stepped profiles of beaver-influenced rivers, with narrow, deep, sinuous reaches above the ponds and shallower reaches of swifter flow below the ponds, maximize the diversity of riparian and aquatic habitats (Wohl, 2005). Beaver dams reduce flow velocities, increase surface water storage, provide slack water habitat, maintain shallow groundwater levels and base streamflow throughout the summer months, increase flooding and floodplain deposition, and increase the interconnectedness of the floodplain with the adjacent stream channel system. Beaver ponds are also known to provide excellent habitat for juvenile coho salmon coho salmon (*Oncorhynchus kisutch*) (Bergstrom, 1985, in Sommarstrom et al., 1990).

With the removal of beavers, beaver dams decayed or were intentionally breached. This probably led to rapid incision into the accumulated fine sediment of the ponded stream reaches, turning them into gullied or entrenched stream channels. Incised channels are characterized by larger, flashier floods, increased sediment yield from unstable and eroding streambeds and banks, and less diverse habitat (Brayton, 1984; Maret et al., 1987, in Wohl, 2005). As occurred along the Colorado Front Range (Wohl, 2005), the net effect of beaver removal along the Scott River was probably a reduction in diversity and stability as low gradient channels locally incised, snowmelt flood peaks increased, flood-related sediment transport increased, and riparian and slow-velocity habitats (as preferred by coho salmon) were lost. Summer baseflows were also probably reduced as a result of the loss of beaver dams and their associated storage capacity and instream flow retention.

Mining and Dredging Operations

The channel changes caused by the removal of beaver may be less substantial and more easily reversed than those associated with changes in regional land use that began with wide-scale placer mining during the 1860s. Gold mining began in the Scott Valley in the 1850s with shallow placer mining occurring in the South Fork, East Fork, Shackleford Creek, Oro Fino Creek, and French Creek (Sommarstrom et al., 1990). Streams were diverted to supply water for placer mining and some of these diversions continue to be used for modern agricultural water supply. Hydraulic mining of the lower Scott River was extensive in the late 1850s. Between 1934 and 1948 large dredge barges operated on about five miles of the mainstem Scott River and in Wildcat Creek. Gold dredging along the Scott River below the town of Callahan from 1934 to 1948 created disruptions of channel processes and surface/subsurface hydrology that persist today (NCRWQCB, 2005). This mining was highly disruptive and its effects have left a strong and continuing legacy of impacts on the Scott River stream system.

Placer and dredge mining have three basic effects on river form and function (Wohl, 2005). First, the disruption of bed and bank sediment renders the sediment more susceptible to being moved by the river flow. This can cause downcutting of the river at the location of the mining or change a meandering river to a braided river (Hilmes and Wohl, 1995). Smaller sediments are preferentially mobilized and winnowed from the disturbed area and accumulate downstream. Downstream accumulation can reduce the river capacity and cause more flooding. The remaining coarse lag is too large to provide spawning gravel for fish whereas the finer sediment carried downstream preferentially fills pools and covers spawning gravel downstream. The river at the mining site remains less stable for decades after mining because the fine-grained bank sediment that once supported stabilizing riparian vegetation is gone (Hilmes and Wohl, 1995). The mining process not only leaves behind windrows of cobble and gravel, as are found along the Scott River, but it also disrupts the stratigraphy of the deposits and greatly increases the permeability of the remaining coarse sediment. This can lead to increased permeability of the river bed and increased subsurface flow, which may then contribute to the loss of surface flow in summer. These persistent geomorphic and hydrologic impacts are all present along the mainstem Scott River and their effects are not easily corrected or mitigated.

Second, toxic heavy metals or mercury used during mining are typically introduced to the stream and retained in valley-bottom sediments. These can have an impact on the biological diversity and productivity of aquatic species in the river system (Wohl, 2005). Finally, placer mining indirectly affects the channel by altering the amounts of water and sediment entering the rivers. These alterations may result from the extensive timber harvest that is required to support large scale mining operations and the settlement that accompanies mining. As with beaver trapping, the net effect of placer mining and associated activities in the Colorado Front Range was to reduce river diversity and stability (Wohl, 2005). Mining and deforestation effects are thought to have greatly exceeded the impacts associated with beaver removal. In the Scott River basin, both actions likely had significant consequences that continue to impact the river system.

Channel Modification and Flood Control

By 1900 the river channel at the northern end of Scott Valley was sinuous and heavily vegetated with cottonwood and willow. The Valley often became a lake during high water (Jackson, 1963; O. Lewis, in Sommarstrom et al., 1990). This type of meandering river is prone to flooding and makes large areas of fertile land unavailable for farming. To improve agricultural opportunities, landowners removed the riparian vegetation and straightened the Scott River channel. In 1938 the Corps of Engineers constructed projects to improve flood control and to channelize the river into a single thread with improved flood flow capacity. They cleared riparian vegetation, straightening the channel in places, and constructed levees in portions of the river from Horn Lane to past Fort Jones (O. Lewis, in Sommarstrom et al., 1990). Aerial photographs of the valley from 1944 reveal large sections of river with little or no riparian vegetation, as well as a very wide channel (600 to 900 feet) near the mouth of Oro Fino Creek. This stream reach has changed little in appearance since that time (Sommarstrom et al., 1990). The middle portions of the river also were altered for flood control. Using pilings, revetments, rock riprap, and sediment excavations, individual landowners have intermittently added to the channel protection measures in order to protect their own lands from channel migration, bank erosion and flooding.

Channel modifications often result in a variety of consequent effects to a stream, and although they may solve one “problem” (e.g., flooding) none of these associated effects lead to a naturally functioning, ecologically healthy aquatic and riparian system. In fact, these flood control projects significantly alter the hydrologic and geomorphic function of the river system at both the landscape and local level (SRWC, 2004). Levee construction confined flood flows to a comparatively narrow channel and increased its erosive power. Rather than spreading out onto the natural floodplain, flood flows caused the channel to incise into the valley alluvium. Straightening a channel increases its gradient, and this increases its power to downcut into the erodible valley sediments; as a result, stream channels often incise and become narrow, deep channels that cause riparian groundwater levels in the adjacent floodplain to drop. This can cause further loss of riparian vegetation and the inability to re-establish a healthy riparian corridor. Additionally, this may limit the long-term recruitment of large woody debris (LWD) which contributes to stream complexity and increases the quality of stream habitat.

Channel straightening, where a meandering channel was once present, also results in accelerated bank erosion. Subsequent bank protection (e.g., rock armoring or sacked concrete) may solve a localized erosion problem, but it often causes increased bank erosion in downstream areas and the resultant need for additional bank protection measures. Bank protection also may remove a local source of gravel recruitment that normally would be delivered to the channel system. Instead, sediment that moves through the confined channel system becomes increasingly fine as it is delivered from distant sediment sources. Further, bank protection tends to result in a simplified channel form and less diverse aquatic habitat by constraining pool and riffle sequences to narrow, confined channels.

Removal of riparian vegetation can also lead to increased rates of bank erosion. Subsequent bank protection efforts then tend to destroy or limit any remaining riparian vegetation and restrict recolonization of the treated sites. Also, pool development by means of scouring (scour pool) is often inhibited along protected cut-banks. Loss of riparian vegetation and scour pool development can lead to increased water temperatures and a reduction in the cool water refugia for aquatic species.

All these effects can be seen along the mainstem Scott River. Channelization has simplified the channel morphology and resulted in greatly reduced aquatic and riparian ecosystem complexity. Rock riprap has been placed for stream bank stabilization by SQRCD and landowners for the past 50 years (SRWC, 2004). The severe flooding that occurred in 1955, 1964, 1974, and 1997 eroded the Scott River’s streambanks and the resultant bank erosion, localized channel widening, aggradation, and shallowing further encouraged the construction of additional bank protection measures. Due to problems created by earlier channelization work, extensive revetment (rock and biotechnical), bank armoring, and channel reshaping work has been “required” through the 1950s and 1960s in an effort to further stabilize the river (Ayres and Associates, 1999).

Although significantly smaller in scale relative to the Scott River, several of the larger tributary streams that enter the Scott River have also been affected by similar problems, and have been straightened and channelized (Ayres and Associates, 1999). For example, emergency flood control work was carried out in 1955 and 1964 by the Corps of Engineers to keep Etna Creek in its channel (USDA, 1971). Similarly, Moffett Creek was moved to the east side of its valley to better make room for agriculture on the flat bottom lands (SHN, 2003). Many of the multi-threaded tributary channels on the westside alluvial fans were likely diverted into single channels, and highly sinuous reaches of meandering channels were straightened by cutting off meander bends (Ayres and Associates, 1999). The abandoned reaches resulting from channelization were reclaimed, and cleared of vegetation providing additional acreage for farming. The most recent channel straightening was done in the early 1980s in the lower mile or so of Kidder Creek, just above its confluence with the Scott River (Sommarstrom et al., 1990). Over the years, landowners have put in pilings, revetments and rock riprap to protect the streambanks. Unfortunately, the perceived need for additional stream stabilization work in the future is unlikely to diminish. The natural channel pattern for alluvial fans is a multi-threaded, braided, distributary channel system that is inherently dynamic and prone to change.

Agricultural Practices and Water Management

Farming and ranching have been an important part of the Scott Valley economy since the mid 1800s. Hay cutting and cattle grazing began in 1851 (Wells, 1881, in Sommarstrom et al., 1990) primarily to support the local miners. Eventually, these activities grew into larger operations that exported some of their goods outside of the Program Area.

With the expansion of agriculture came changes to the structure and function of some of the Valley's vegetation and rivers. At the turn of the twentieth century, historic accounts (Jackson, 1963 and O. Lewis, in Sommarstrom et al., 1990) suggest the river channel at the northern end of the Scott Valley was meandering and heavily vegetated with cottonwood and willow; and the valley often became a lake during high water. To bring this land into agricultural production, landowners removed the brush and straightened the channel (Sommarstrom et al., 1990). Native bunch-grass and clover gave way to farmed crops in fertile soil and grazing reduced the amount of perennial grasses and forbs in the uplands over the years (SRWC, 2006; KNF, 2000, in SRWC, 2006).

The diversion and extraction of water from the Scott River watershed and its tributaries also began in the 1850s. Until the late 1960s, agricultural water was mainly derived from surface water diversions from the Scott River and its tributaries; flood irrigation was the primary application method (McCreary-Korestsky, 1967, in SRWC, 2006). Groundwater wells were few at this time and most wells were shallow and only used for domestic and stock supplies.

Agricultural activities have had effects (direct and indirect) on the geomorphology and water quality of the stream system and contributed to the decrease in the productivity of the Scott River's anadromous fisheries (as discussed in Chapter 3.3, Biological Resources: Fisheries and Aquatic Habitat). Most notably, water diversions, primarily for agricultural purposes, have led to decreased surface flows and increased stream temperatures. Further, stream channels have been altered and riparian vegetation removed as a consequence of agricultural activities (by 1944, aerial photographs reveal large sections of the river with little or no riparian vegetation), including land clearing, tillage, and grazing, which in turn has lead to accelerated erosion and increased stream sediment loads.

Grazing. Grazing in the riparian corridor has been acknowledged as contributing to the degradation of aquatic habitat in the Scott River upstream of the Canyon (NRC, 2004). Livestock grazing is a Covered Activity under the Program and, similar to some other Covered Activities, it is not new; rather, it has been occurring in the Program Area for decades. Hence, authorizing livestock grazing as part of the Program will not cause the level of grazing to increase or result in any impacts in addition to those that are already part of baseline conditions in the Program Area. In fact, the Program will likely reduce the impacts of grazing by excluding livestock from some riparian areas by installing and maintaining fencing (see ITP and MLTC Covered Activity 5). Also, where riparian fencing is constructed as part of the Program, any grazing of livestock adjacent to the channel or within the bed, bank, or channel of the Scott River or its tributaries may only occur in accordance with a grazing management plan that will result in improved riparian function and enhanced aquatic habitat.

Water Right Adjudications and Diversions. All surface water rights in the Program Area upstream of the USGS gaging station (no. 11519500, approximately 10 miles downstream from Fort Jones) are adjudicated according to one of three decrees: the Shackleford Creek Decree (1950), the French Creek Decree (1958), and the Scott River Decree (1980). The decrees, as explained by Scott River Watershed Council (SRWC) (2006), have defined: 1) the amount of water each user is entitled to divert from surface streams or to pump from the interconnected groundwater supplies near the river; 2) the area where such water may be used; 3) the priority of each water right as it relates to other water rights on the same source; 4) the purpose for which the water is used (e.g., irrigation, municipal, domestic, stock-water); and 5) the diversion season. All appropriative claims prior to 1914 and riparian water rights were included in all of the court adjudicated decrees within the Scott River watershed (SRWC, 2006). The decrees quantified the following allotments of water under the respective adjudications: 894.29 cubic feet per second (cfs) under the Scott River Decree,[3,4] 36.51 cfs under the French Creek Decree, and 69.55 cfs under the Shackleford Creek Decree. According to hydrologic analyses by USGS (2006a), this total allotment is greater than the average monthly flow of the Scott River from June through December, based on 64 years of record. **Tables 3.2-2**, **3.2-3**, and **3.2-4** further detail the diversions and water allotments defined in the decrees (SWRCB, 2008).

Since 1989, Scott River, French Creek, Kidder Creek, Shackleford Creek, and Mill Creek have been considered “fully appropriated” by the State Water Resources Control Board (SWRCB) (SRWC, 2006). The Scott River and most of its tributaries do not have appointed watermasters and, consequently, there is no way to verify whether water diversions are in compliance with existing water rights (DWR, 1991). However, watermaster service is presently used for 102 decreed water rights holders in French Creek, Oro Fino Creek, Shackleford Creek, Sniktaw Creek, and Wildcat Creek (SRWC, 2006).

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3 In the Scott River Decree, water use is allocated according to four schedules, Schedules A through D. Schedule A pertains to a limited number of named and unnamed springs, Schedule B pertains to tributaries to the Scott River. Schedule C pertains to the interconnected groundwater zone. Schedule D pertains to the mainstem Scott River. Only allotments in Schedules B and D have been quantified in terms of diversion volumes in cubic feet per second, and the value presented here represents only the total volume quantified in Schedules B and D.

4 In addition there are water rights listed in Schedule C of the Scott River Decree for which no specific quantities of water are identified. These water rights allot the amount of water “that is reasonably required to irrigate the acreages” identified in Schedule C, either by sub-irrigation or pumping from groundwater interconnected with the Scott River.

TABLE 3.2-2
SUMMARY OF ALLOTMENTS FROM SCHEDULES B THROUGH D OF THE SCOTT RIVER DECREE (1980)

Schedule/ Group	Water Body (Primary)	Water Body (Specific Reaches/Designation)	No. of Identified Diversions	Total Allotment (cfs)
Schedule B				
B1	East Fork	Upper Tributaries only	6	6.32
B2	Rail Creek	and Tributaries	7	10.33
B3	East Fork	Middle Tributaries only	14	8.91
B4	East Fork	Lower Tributaries only	18	21.29
B5	East Fork	above Rail Creek	16	35.67
B6	East Fork	Rail Creek to Grouse Creek	11	19.44
B7	East Fork	Grouse Creek to SF Scott River	7	7.77
B8	South Fork	Tributaries only	16	9.58
B9	South Fork		8	8.05
B10	Wildcat Creek	and Tributaries	9	7.49
B11	Sugar Creek	and Tributaries	8	25.58
B12	Messner Gulch, Cedar Gulch, Facey Gulch	and other Tributaries of the Scott River	20	4.70
B13	McConaughy Gulch	and Tributaries	6	3.57
B14	Wolford Slough	and Tributaries	5	6.62
B15	Clark Creek		5	15.06
B16	Etna Creek	Tributaries only	10	2.29
B17	Etna Creek	Upper (including Etna Mill Ditch)	6	13.72
B18	Etna Creek	Lower (downstream of Etna Mill Ditch)	12	36.40
B19	Shell Gulch, Hurds Gulch, Hamlin Gulch	and Tributaries	8	4.19
B20	Johnson Creek	and Tributaries	13	18.70
B21	Crystal Creek		5	11.30
B22	Patterson Creek (West)		7	35.48
B23	Big Slough	and Tributaries	18	37.82
B24	Kidder Creek	Tributaries only	3	6.53
B25	Kidder Creek	Upper	13	91.93
B26	Kidder Creek	Lower	13	53.04
B27	Moffett Creek	Upper, and Tributaries	29	12.10
B28	Duzel Creek	and Tributaries	12	2.76
B29	Moffett Creek	Lower	26	26.26
B30	Soap Creek	and Tributaries	8	1.42
B31	Moffett Creek	Lower, Tributaries only	6	3.36
B32	McAdam Creek	and Tributaries	28	14.68
B33	Indian Creek	and Tributaries	13	12.58
B34	Oro Fino Creek	and Tributaries	16	21.74
B35	Rattlesnake Creek	and Tributaries	9	6.14
B36	Tyler Gulch	and Tributaries	5	0.96
B37	Patterson Creek (North)	and Tributaries	9	2.03
B38	Sniktaw Creek	and Tributaries	18	10.68
B39	Lower Scott River	Tributaries only	11	0.68
B40	Graveyard Gulch, Meamber Creek, and Meamber Gulch		5	2.90
Schedule C	"Interconnected Groundwater"		74	12,975[1]
Schedule D				
D1	Scott River	EF/SF confluence to lower end of Tailings	12	49.25
D2	Scott River	lower end of Tailings to SVID diversion no. 223	19	128.16
D3	Scott River	SVID diversion no. 223 to diversion no. 576	23	71.56
D4	Scott River	diversion no. 576 to USGS gaging station	15	20.58
D5	Scott River	USGS gaging station to Klamath River	20	4.67
TOTALS[2]			**548**	**894.29**

1 Total number of irrigated acres (specific allotments were not identified)
2 The TOTAL in the Total Allotment column is for Schedules B and D only.

SOURCE: Scott River Decree (1980)

TABLE 3.2-3
SUMMARY OF ALLOTMENTS FROM THE FRENCH CREEK JUDGMENT (1958)

Schedule/Group	Water Body	No. of Identified Diversions	Total Allotment (cfs)
Table 1	French Creek (Springs and Unnamed Streams)	10	0.84
Table 2	French Creek (North Fork)	3	7.98
Table 3	Miner's Creek	8	3.20
Table 4	French Creek, Payne Lake Creek, Horse Range Creek, and Duck Lake Creek	27	24.49
Totals		**48**	**36.51**

SOURCE: French Creek Judgment (1958)

TABLE 3.2-4
SUMMARY OF ALLOTMENTS FROM THE SHACKLEFORD CREEK DECREE (1950)

Schedule/Group	Water Body	No. of Identified Diversions	Total Allotment (cfs)
Schedule 3	Shackleford Creek (Upper)	8	28.93
Schedule 4	Shackleford Creek (Lower)	9	25.50
Schedule 5	Mill Creek (Upper)	2	10.62
Schedule 6	Mill Creek (Lower)	6	4.50
Totals		**25**	**69.55**

SOURCE: Shackleford Creek Decree (1950)

Over 200 miles of ditches and canals distribute water from the Scott River and its tributaries to users throughout the watershed. There are no large surface water storage facilities within the Scott Valley, though there are several small local impoundments (Deas and Tanaka, 2004). The largest water storage location in the watershed is the aquifer beneath the alluvial Valley.

Stream Restoration Efforts

In many areas within the Program Area, the impacts of past and present activities have been acknowledged and documented, and measures to restore the geomorphic structure and ecological function of the riverine habitat have been implemented. Watershed-wide evaluation of issues and establishment of restoration priorities came under the purview of the Scott River Coordinated Resource Management Plan (CRMP) in the 1980s and 1990s. The Scott River CRMP evolved into the current SRWC, which has prepared a “Strategic Action Plan” for restoration of the watershed’s fisheries (SRWC, 2006). Restoration projects over the past two decades have included stream bank stabilization and riparian planting projects undertaken cooperatively by farmers, the Natural Resources Conservation Service (NRCS), and SQRCD (SRWC, 2006).

Some of the restoration projects have focused on placing instream structures to improve fish habitat and, in a broader context, the natural geomorphology of the channel. Instream restoration projects have included bank stabilization and modification of existing diversion structures to provide for fish passage (e.g., installation of boulder weirs, instead of traditional dams, to provide for fish passage). Some of the bank stabilization projects have focused on softer, “geomorphically-based” means of stabilization as an alternative to the traditional approach of simply using concrete and rip-rap. SRWC (2006) estimates that over 300 instream projects have been carried out and over 17,000 feet of stream channel enhancement projects have been implemented in the Program Area.

Existing Hydrologic and Geomorphic Conditions

Based on review of Quigley et al. (2001) and SQRCD (2005), and consideration of the Program Area climate, topography, vegetation, channel geomorphology, and hydrology, the Program Area is delineated into nine sub-basins in order to characterize existing conditions: the Scott Valley, the Canyon (lower Scott River), the Eastern Headwaters, the Western Headwaters, Sugar Creek and Wildcat Creek, French Creek (including Miner’s Creek), the Westside Tributaries, Shackleford Creek (including Mill Creek), and the Eastside Tributaries (Moffett Creek). These basins, as well as the principal tributaries within the Program Area are shown in **Figure 3.2-4**; selected longitudinal profiles from these sub-basins, as derived from topographic maps, are presented in **Appendix F**.

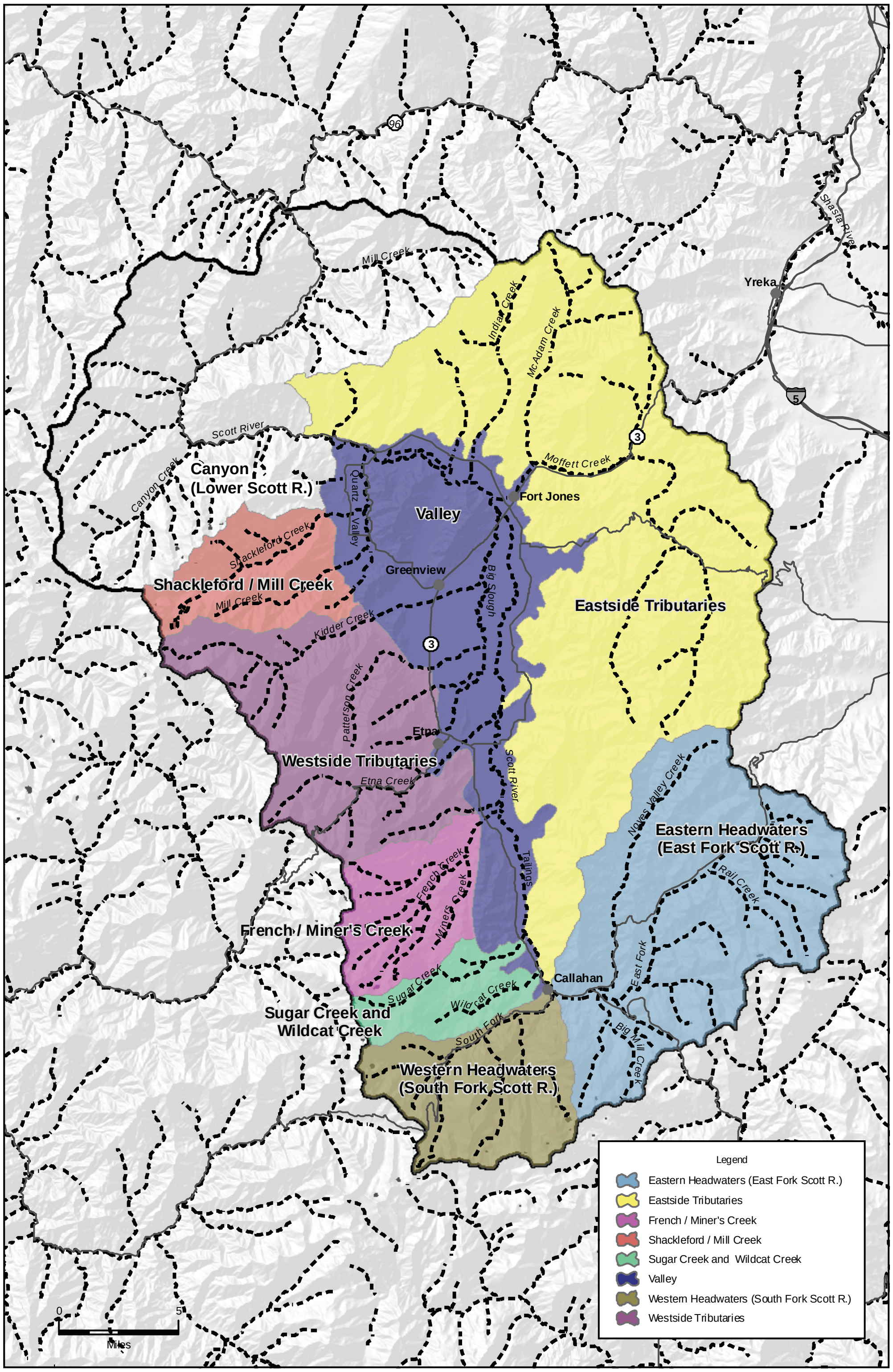
Given the broad scale of the Program and the scope of this Draft Environmental Impact Report (EIR), to the degree that important parameters and/or criteria can be quantified, the discussion here is for the most part limited to the mainstem Scott River upstream of the Canyon area. The overall flow regime, and changes thereto, are described from analysis of the USGS gaging record for the Scott River near Fort Jones (USGS station no. 11519500). Trends from this gaging record are indicative of the hydrologic conditions within the Program Area as a whole.

Scott River Watershed (General) – Scott Valley (Scott River Mainstem)

General Morphology and Sediment Characteristics

The Scott Valley represents a low gradient section between two high gradient areas, the headwaters and the Canyon reach. The Valley portion of the Scott River, from the confluence of the East and South Forks to the head of the Canyon, stretches from south to north for about 30 miles. Elevations in the Valley range from 2,630 to 3,120 feet amsl. The major morphological features of this section include the large alluvial fans deposited by the western tributaries and the alluvial floodplain of the Scott Valley.

The mainstem Valley bottom of the Scott River is low relief with relatively low precipitation. It is underlain by Quaternary age alluvium. The eastern valley side slopes are also characterized by low precipitation, and because significant drainage from much of the eastern hillsides (except Moffett Creek) does not directly reach the Scott River, it is considered a low sediment contribution area (SQRCD, 2005). In contrast, the western mountains are high elevation and contain a number of streams with perennial connection to the Scott River. Drainage areas are large, streamflow is comparatively high, and sediment yields are much greater (especially from west side sub-watersheds underlain by erodible granitic bedrock and soils). The largest west side



SOURCES: California Department of Conservation (2006), CGS (2005), ESA (2007)

Figure 3.2-4
Scott River Subwatersheds

tributaries terminate on the western Valley margin as large, gentle alluvial fans where sediment loads are dropped near the mountain front and braided or anastomosing stream channels shift across the fan surfaces before reaching the mainstem Scott River.

The mainstem Scott River in the Valley can be divided into two sections that exhibit certain common morphological characteristics (SQRCD, 2005). The upper section (Reach 1) includes about 13 miles of the Scott River, which runs south to north through the southern portion of Scott Valley with an elevation change of about 220 feet. Reach 1 begins at the confluence of the East and South Forks and ends at the Scott River's confluence with Etna Creek. Overall channel slope is about 0.3 percent. The upper five miles of this reach are heavily impacted by historical mining and large piles of tailings cover the entire width of the floodplain in this section. The tailings form a barrier between the river and its floodplain and are a source of cobble and gravel that contributes to unstable and aggraded conditions downstream. During summer months, flow through the northern portion of the mine tailings can go subsurface resulting in 1.5 miles of dry river bed.

Reach 1 consists of a wide, flat floodplain and a sinuous channel pattern where bars, islands, and side and/or off-channel habitats are common (SQRCD, 2005); areas of overhanging riparian vegetation are rare. The side channel to the west of the active channel is disconnected. There is no connected floodplain through the tailings segment of Reach 1, and mining has greatly coarsened the bed of the river. In the tailings segment, the channel is wide, shallow, and locally unstable, side channels are few, and lateral scour against the tailings during flood events provides excessive sediment supply to downstream areas. Channel instability and lack of floodplain soils within the tailings area prevent the establishment of riparian vegetation. From the Scott Valley Irrigation District (SVID) diversion site to the Etna Creek channel confluence down-cutting of the mainstem channel is occurring. This makes restoration or establishment of riparian vegetation difficult, though the channel is laterally stable in this segment (SQRCD, 2005).

In the lower reach (Reach 2), the mainstem Scott River from Etna Creek to the Canyon includes about 17 miles of the Scott River which runs south to north turning west near Fort Jones where it drains into the Canyon three miles below the confluence with Shackleford Creek. Elevation ranges from a high of 2,900 feet at Etna Creek to 2,630 feet at the heading of the Canyon area (average slope is 0.4 percent). The river has created a wide, flat floodplain and a sinuous channel pattern where bars, islands, side and/or off-channel habitats are common. A significant reach of the Scott River through Scott Valley is very flat (approximately 0.02 percent slope) and is a sand dominated channel, while the northern and southern ends of this stream reach possess coarser bed materials, including gravels (SQRCD, 2005). Although the low gradient reaches of the river in Scott Valley represent a natural area of sediment deposition, considerable channel alteration of the Scott River over the years has changed its sediment storage and transport capacities. The greatest amount of sand in channel storage is in the reach between Oro Fino Creek and the State Highway 3 bridge near Fort Jones (Sommarstrom, et al, 1990).

Significant portions of the Scott River in Reach 2 have been straightened, banks have been stabilized using riprap to prevent erosion and flood control levees prevent the river from accessing of the floodplain. This reach of the Scott River is entrenched and there is only a narrow band of land where riparian vegetation establishes naturally. The side-channels present in this reach are only active during very high flow events.

Groundwater

Groundwater use in the Scott Valley has increased dramatically over the last few decades. In the year 2000, DWR (as cited in SRWC, 2006) estimated that 45 percent of the irrigated acres in the Scott Valley were using groundwater, compared to 2 percent just over 30 years ago. **Table 3.2-5** compares the composition and volume of water utilized in the Scott River watershed in 1958 and in 2000 (DWR data in SRWC, 2006; Naman, 2005). According to Table 3.2-2, the increase in the volume of water utilized has consisted almost exclusively of groundwater. Unlike some of the surface diversions, in the Scott River watershed there is no regulation, management, or quantification of the extraction of water from wells, other than the minimal regulation that occurs within the "interconnected zone" specified in the Scott River Decree (Naman, 2005).

TABLE 3.2-5
WATER UTILIZATION IN THE SCOTT RIVER WATERSHED, 1958 AND 2000

	1958		2000	
Water Type	**Volume (ac-ft)**	**Percentage**	**Volume (ac-ft)**	**Percentage**
Groundwater	900	2%	29,250	45%
Surface water	38,700	86%	31,200	48%
Mix	5,400	12%	4,550	7%
Total	45,000	100%	65,000	100%

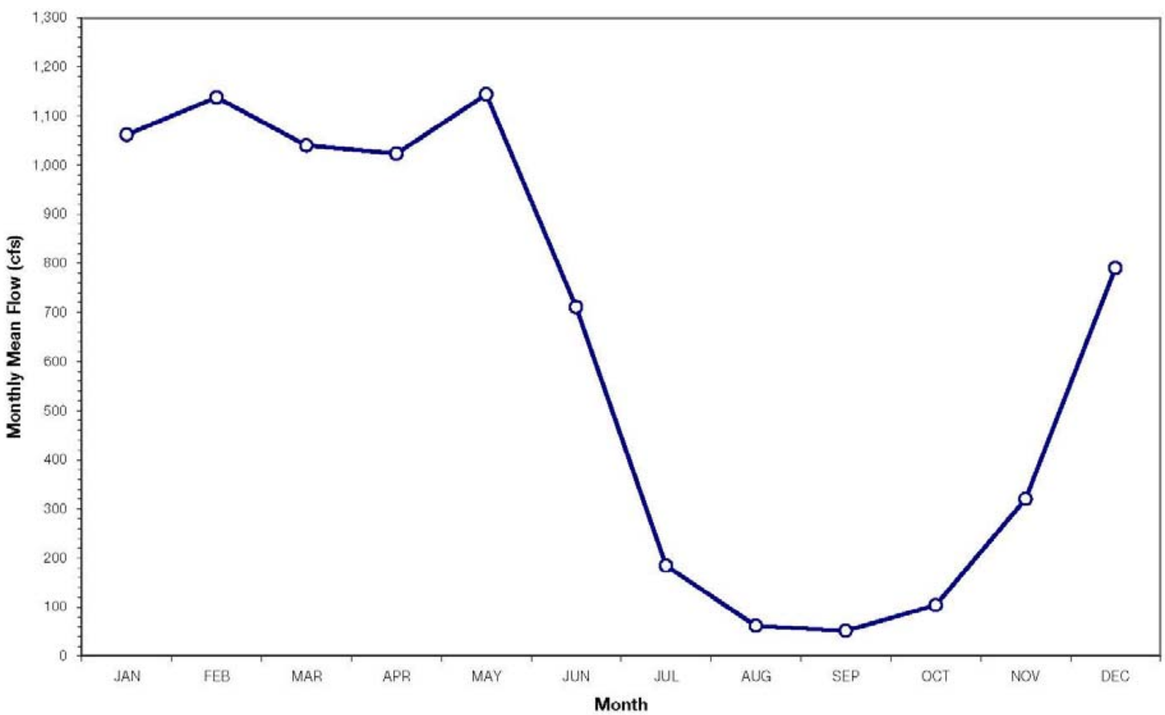
SOURCE: DWR data in SRWC, 2006; Naman, 2005

Limited data on groundwater levels exist for the Scott Valley. DWR collected groundwater data throughout the Scott Valley in August of 1990. While these groundwater data are not conclusive, they do suggest that even in August of a dry year, groundwater still moves toward the river in most of the Scott Valley. During the 1989 and 1990 summers, there was continuous surface flow at all the major bridges on the Scott River. Although surface flows were not continuous at all points along the river, groundwater apparently continued to recharge the river (DWR, 1991). Based on DWR monitoring data collected since 1965 from two monitoring wells near the Scott River and one well one mile from the river, SRWC (2006) concluded that groundwater levels have remained fairly constant over the last 40 years and have recharged for the most part each year. However, review of these same data suggests that the draw-down of the water table in the fall may be getting more pronounced compared to 40 years ago. The difference between a dry stream and a flowing stream may be a matter of only a few feet, and it is not possible to assess the connection between the groundwater and surface flow based upon two measurements per year at a limited number of locations.

Surface Water Hydrology and Flow Regime

Description of the general hydrologic regime of the Scott River through the Valley is derived primarily from 64 years of data (WY 1942 through 2005) from the USGS gaging station (no. 11519500) located downstream of Fort Jones. This is the oldest operating stream gage in the Program Area. Mean monthly discharge for this station over the period of record is summarized in **Figure 3.2-5**. The total annual discharge (and water yield for irrigators) can vary greatly from year to year; variations in flow within the same year can also be substantial. Despite the inherent variability of the Scott River flow regime, the river exhibits a general, seasonal trend (**Figure 3.2-6**) that is consistent in all but the most extreme water years. This general trend is described succinctly by USFS:

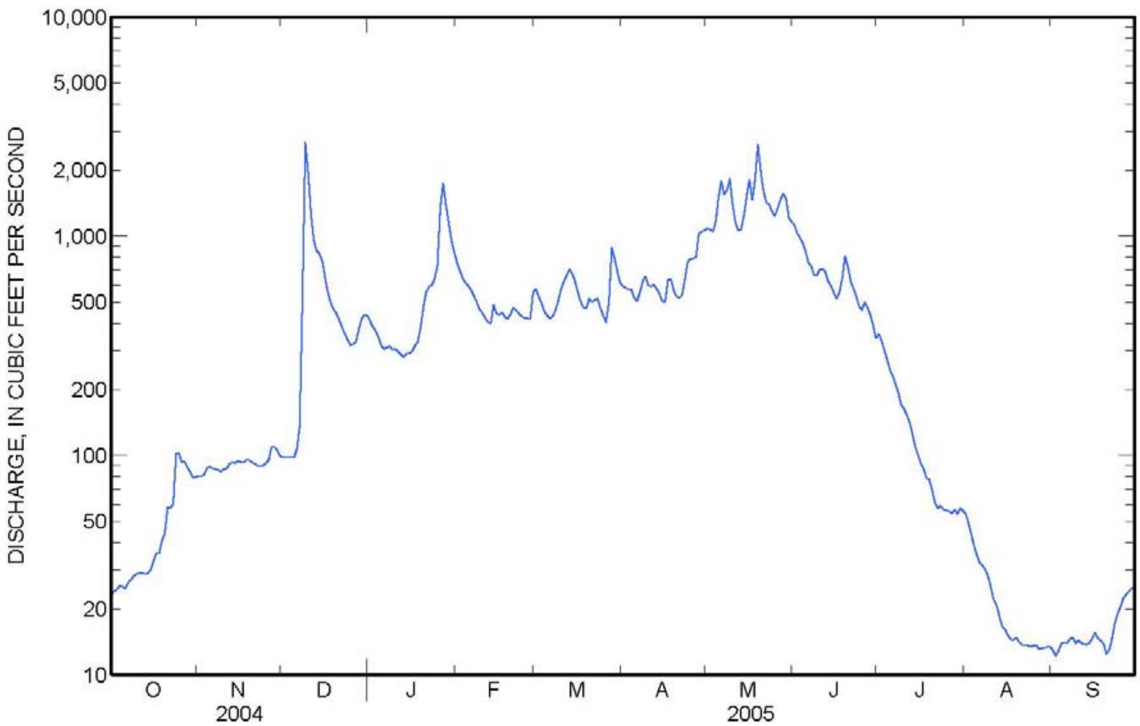
> Water discharge levels typically rise in November to late December in response to fall rains; peak discharge in January and February in response to large winter storms; a slight decrease in late March or early April as storms decrease and temperatures remain low; an increase in April to June from snowmelt; and a rapid decrease in discharge in June to August as snowmelt diminishes and storms have ceased. It is also evident that in every year, regardless of whether the winter was wet or dry, summer flow levels decrease to very low in August to September. This is in response to a combination of natural and man-made situations: hot days with no precipitation and intensive use of water for agriculture in Scott Valley. (USFS, 2000b, in NCRWQCB, 2005)



SOURCE: USGS (2006a)

Scott River Watershed-Wide Permitting Program . D206063

Figure 3.2-5
Mean Monthly Flow of the Scott River, USGS Gage No. 11519500 (WY 1942-2005)



SOURCE: USGS (2006a)

Scott River Watershed-Wide Permitting Program . D206063

Figure 3.2-6
Daily Flow of the Scott River for WY 2005
(USGS Gage no. 11519500)

Water availability in the critical months (i.e., later summer and early fall), both for irrigation and for instream fish habitat, is ultimately determined by rainfall and snow amounts and the interaction of these two elements during the previous winter season. Many of the tributaries of the Scott River originate from high-altitude lakes located near the summits of the surrounding mountain ranges; flow in the Scott River is thus extended into the summer dry period by the melting snowpack of the Scott, Salmon, and Marble Mountains (DWR, 1991). Factors such as early season snowmelt or more precipitation as rain instead of snow contribute to lower late summer and fall flows compared to annual precipitation totals (SRWC, 2006).

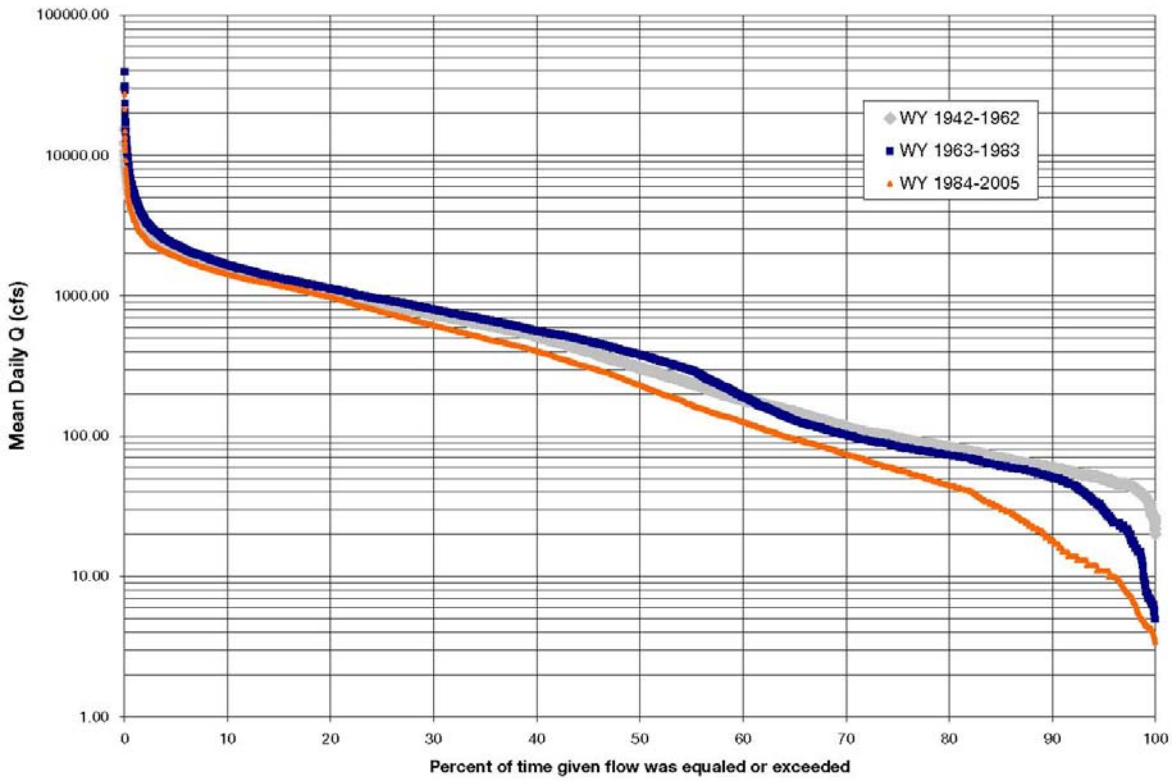
In addition to the natural recession of runoff, stream diversions during the dry months further decrease the volume and duration of baseflows. The demand for irrigation water and the amount of water allocated under the three decrees for the Program Area is typically in excess of surface flow sources during the summer and fall. Consequently, the entirety of late summer and early fall streamflows in the Valley may be – and sometimes are – diverted under water rights defined by the court decrees. Also, during dry years surface diversions often cease in the late summer months because there is little or no surface water available, and diverters subsequently rely exclusively on groundwater for the remainder of the irrigation season.

The west side of the Valley is irrigated mainly by tributaries originating from the Salmon and Marble Mountains, and the east side of the valley is irrigated mainly by stream diversions from the Scott River. Over the past 40 years, many agricultural operations have switched partly or wholly from surface water to groundwater. The principal method of irrigation has also shifted, from flood irrigation to the use of more efficient sprinkler irrigation. A comparison of water utilization and irrigated acres from 1958 to 2000 indicates a substantial increase in the fraction of irrigation withdrawal made up of groundwater (DWR data, in Naman, 2005; Van Kirk and Naman, 2008). Over this same time period, the total number of irrigated acres in the Scott Valley has changed little. Well drilling peaked after the 1976-77 drought, with a smaller increase again occurring in 1992 during another drought period. Irrigation well yields range from 30 to 3,000 gallons per minute (gpm) (DWR, 2004).

Most diversions are not monitored or watermastered, and therefore only gross estimates of water taken from the river can be made based upon adjudicated volumes (or rates) and estimates of applied water use. One estimate of water applied for agricultural use in the Scott Valley is 98,100 acre-feet, while evapotranspiration (ET, the loss of water from the land through transpiration of plants and evaporation from the soil and surface water-bodies) is estimated to be 78,000 acre-feet – the difference is accounted for by losses due to deep percolation, ditch loss and runoff (SRWC, 2006). Another estimate of water utilization in the Scott Valley in the year 2000 was 65,000 acre-feet (DWR data, in Naman, 2005). Most of the irrigation diversions and groundwater extractions in the Scott Valley occur during later spring, summer, and early fall. However, the actual irrigation season may vary depending on weather conditions (e.g., early rains and mild temperatures may offset the need to irrigate into October). Diversions from streams for both stock water and domestic use also occur throughout the year. Many domestic users are scattered throughout the valley and foothills of the Scott River watershed and utilize groundwater from individual wells (SRWC, 2006).

Partly as a result of stream diversions and increased groundwater extraction, the volume and duration of baseflows (i.e., late summer and early fall) in the Scott River has decreased over time and further limited spawning and rearing habitats for fish species. Such conditions normally occur during the months of July through October. **Figure 3.2-7** depicts a series of flow duration curves, each spanning a time frame of about twenty years, over the period of record for the USGS gaging station downstream of Fort Jones. The flow duration curve is one of the simplest means of expressing the time distribution of discharge; the upper end of the curve is primarily determined by regional climate, while the lower end of the curve is primarily determined by geology and topography, under natural conditions. A steeply sloping duration curve is characteristic of a highly variable stream, the flow of which is primarily from direct runoff (Leopold, 1994), while a flat curve typically suggests a pronounced groundwater and/or spring (snowmelt) runoff influence. A sharp drop at the end (right-hand side) of the curve indicates a lack of groundwater input and/or a suppressed baseflow condition.

Over time, a lasting and continual decrease in baseflow volumes and duration can have a substantial effect on the quantity and quality of instream habitat as well as the condition of the riparian corridor. Low flows reduce the amount of instream habitat and generally increase



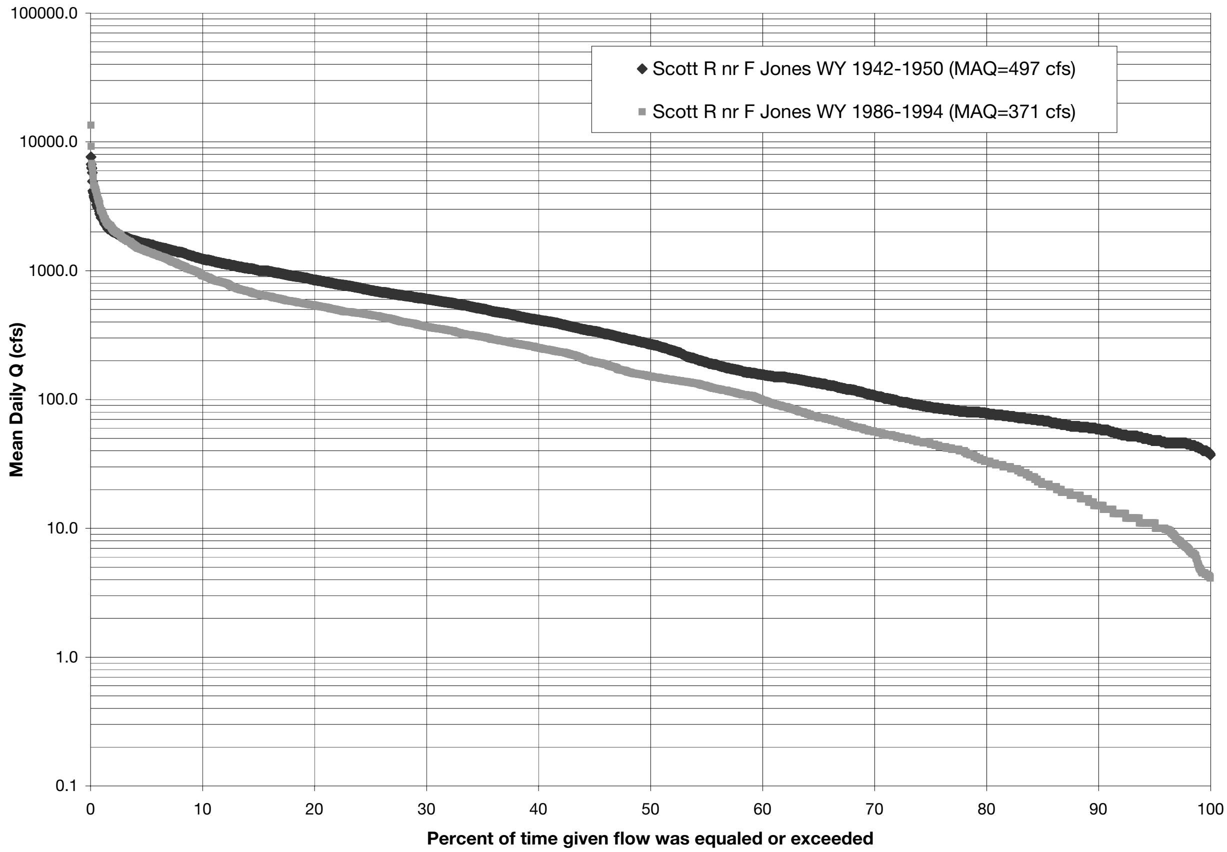
SOURCE: USGS (2006b); ESA (2007)

Scott River Watershed-Wide Permitting Program . D206063

Figure 3.2-7
Scott River Flow Durations
(USGS Gage No. 11519500)

ambient water temperatures. Further, reduction in low flow levels can lower the streamside water table, making it difficult or impossible to maintain a healthy corridor of riparian vegetation. The loss of stabilizing vegetation can subsequently lead to increased rates of bank erosion and channel incision during high flow periods. As well, NCRWQCB (2005) concluded that stream shade, or lack thereof, provided by riparian vegetation has a large effect on ambient stream temperature. All of these processes and effects are evident in the Program Area and, in part, characterize the existing hydrologic and geomorphic condition of the Scott River.

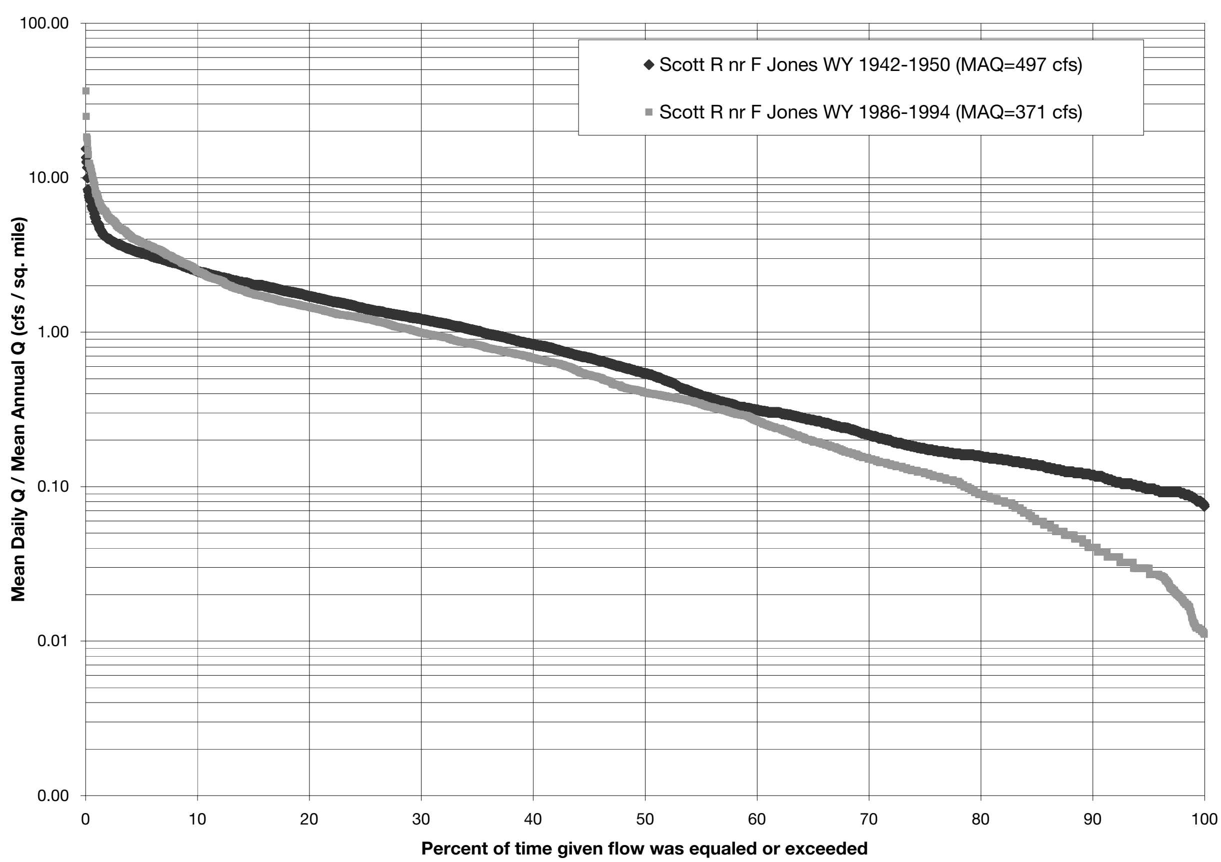
Figures 3.2-8 and **3.2-9** compare flow duration characteristics of the Scott River and the Salmon River (an adjacent watershed to the southwest) for two extended dry periods, WY 1942 to 1950 and WY 1986 to 1994. The curves are normalized for two general parameters: average runoff (to account for precipitation differences between time periods, and differences in relative magnitude of runoff between the two watersheds) and drainage area (to account for the different-sized watersheds of the Scott River and the Salmon River). Figure 3.2-9 is notable in that, when comparing normalized hydrologic parameters, the Scott River from WY 1942 to 1950 exhibits almost the same characteristics as the Salmon River (the Salmon River is unregulated with no significant upstream storage or large diversions). Further, the Scott River from WY 1986 to 1994 exhibits a marked depression in baseflow volumes and duration in comparison to either the Salmon River over the same time period (WY 1986 to 1994) or to the Scott River of 40 years ago.



Scott River Watershed-Wide Permitting Program . D206063

SOURCE: USGS (2006b); ESA (2007)

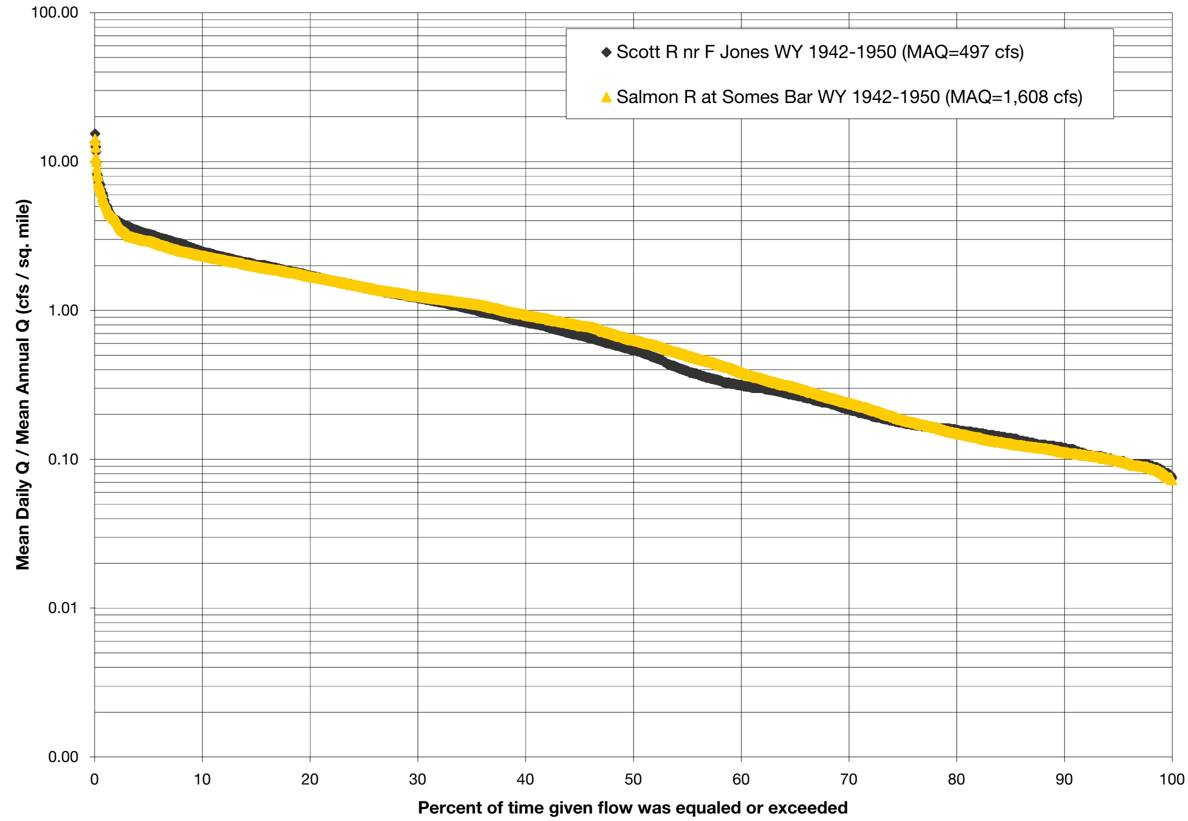
Figure 3.2-8a
Scott River Dry Period Flow Durations



Scott River Watershed-Wide Permitting Program . D206063

SOURCE: USGS (2006b); ESA (2007)

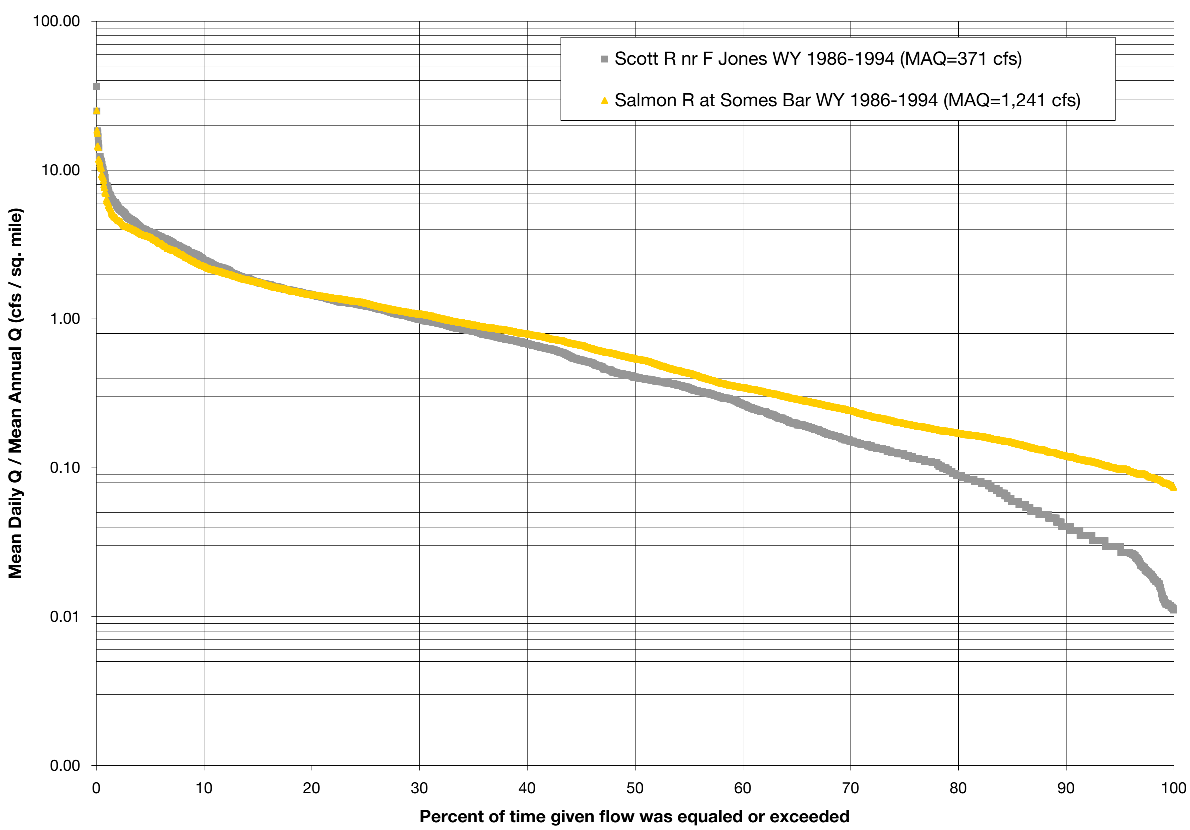
Figure 3.2-8b
Scott River Dry Period Flow Durations (Normalized by Drainage Area and Mean Annual Discharge for the Respective Period)



SOURCE: USGS (2006b); ESA (2007)

Scott River Watershed-Wide Permitting Program . D206063

Figure 3.2-9a
Scott and Salmon Rivers Normalized
Dry Period Flow Duration Curves (WY 1942-1950)



SOURCE: USGS (2006b); ESA (2007)

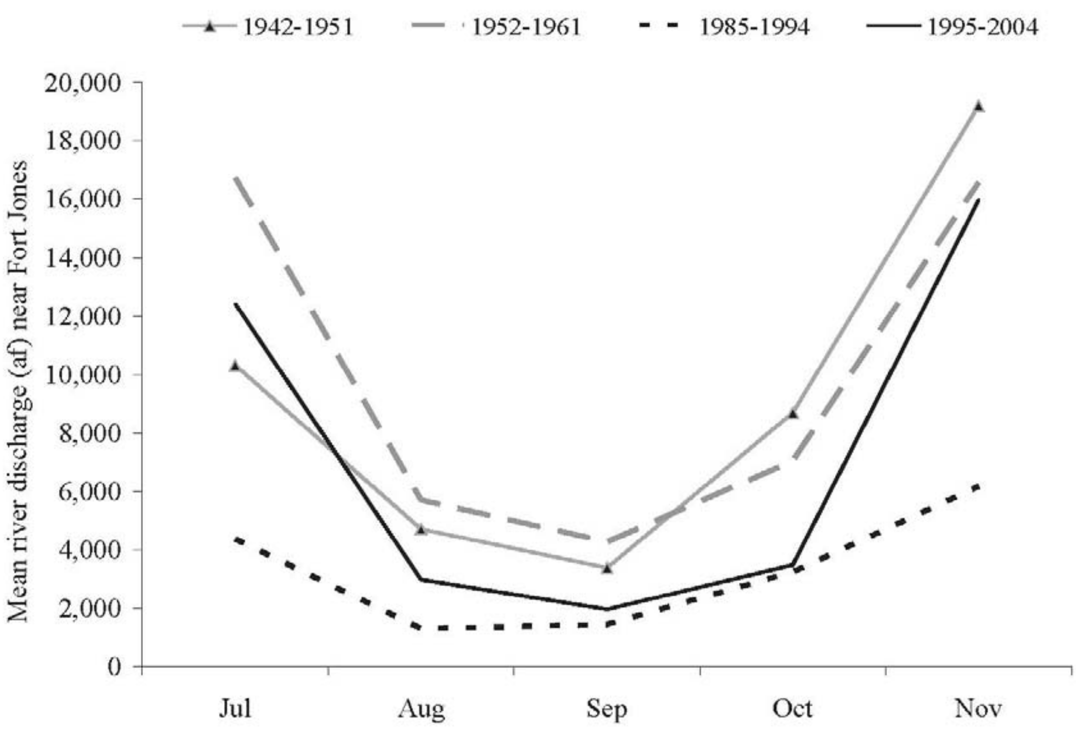
Scott River Watershed-Wide Permitting Program . D206063

Figure 3.2-9b
Scott and Salmon Rivers Normalized
Dry Period Flow Duration Curves (WY 1986-1994)

The Scott River, over the most recent dry period, exhibits a measurable decrease in the volume and duration of baseflow. Compared to the dry period of WY 1942 to 1950, the dry period of WY 1986 to 1994 had a 10 percent reduction in number of days experiencing a mean daily flow of 100 cfs, and a 20 percent reduction in the number of days experiencing a mean daily flow of at least 35 cfs. Approximately 657 days during the WY 1986 to 1994 period (or, an average of 73 days per year) had a mean daily flow of less than 30 cfs, while the mean daily flow during the entire WY 1942 to 1950 time period never fell below 37 cfs. Maintenance of baseflow is a recognized and important aspect of water quality with regards to salmonid habitat and health (CDFG, 2002; NRC, 2004; SSRT, 2003). In the Scott River Decree, USFS was allotted a water right for instream use for fish and wildlife. During the summer and early fall, the decree allotted USFS 30 to 40 cfs, as measured at the USGS gaging station (no. 115195000) below Fort Jones. These were considered the necessary levels to provide minimum subsistence-level fishery conditions, and can be experienced only in critically dry years without resulting in depletion of the fishery resource (Scott River Decree, 1980); on average, these levels are not currently being met. One fifth of the days during the last extended dry period fell below this subsistence level, and examination of the stream record over the last decade indicates that this is often the case even during average and above average individual rainfall years.

The decline in Scott River baseflow volumes and durations can be attributed, in part, to an increase in overall consumptive water use as well as the amount of water taken from groundwater sources. The period of 1942 to 1950 was prior to the establishment of the first adjudication settlement in the Program Area (i.e., the Shackleford Creek Decree) and the diversion of surface water, which was the dominant (if not exclusive) source at that time, was not regulated by statutory adjudication. As discussed above, groundwater use increased dramatically beginning in the 1990s. In essence, Figures 3.2-8 and 3.2-9 compare a dry period that occurred before much (if any) groundwater was being used to a subsequent dry period during which the use of groundwater played a greater role. The marked decline in baseflow is likely, in part, attributable to the increase in groundwater consumption. Comparing historic (1942-1976) to modern (1977-2005) periods, Van Kirk and Naman (2008) noted a significant decline in Scott River discharge during the low-flow season (approximately July through October); the authors attributed over 60 percent of this observed decline to local factors such as increases in irrigation withdrawal and consumptive use. **Figure 3.2-10** further demonstrates that, regardless of water year-type or extended wet and dry periods, Scott River flows during the late summer and early fall have decreased over time. For example, in Figure 3.2-10 the discharge curve for the more recent, relatively wetter period (1995 to 2004) crosses and falls below the discharge curve for the historic, relatively drier period (1942 to 1951).

Scott River Decree (1980). The Scott River Decree was finalized in January of 1980, and it included decisions on water rights for the Scott River, South Fork Scott River, East Fork Scott River, Wildcat Creek, Oro Fino Creek, Sniktaw Creek, numerous other tributaries (as well as several lakes), and an area of the Groundwater Basin delineated as being interconnected with river flow (see Table 3.2-2). Most of the irrigation diversions on the Scott River operate from April 1 through October 15 pursuant to the decree. Use of groundwater not considered interconnected with the Scott River does not currently require a water rights permit and is not subject to adjudication.



SOURCE: Naman (2005)

Scott River Watershed-Wide Permitting Program . D206063

Figure 3.2-10
Scott River Monthly Discharge Comparison (July through November), Selected Periods

The two largest diversions (and allotments) on the mainstem Scott River are the Farmers Ditch and the Scott Valley Irrigation District (SVID) ditch. DWR (1991) characterizes these ditches as follows:

- The Farmers Ditch is located within the tailings section of the Scott River, just downstream of the Sugar Creek confluence (within Reach 1, discussed above). The Farmers Ditch Company owns and operates the ditch to supply 10 users and most of the water is applied to irrigated pasture. The Scott River Decree allocates 36.0 cfs to the Farmers Ditch (22.3 cfs for consumptive use and 13.7 cfs for ditch losses). Typically, in August and September the ditch has the right to divert the entire natural flow of the Scott River.

- The SVID ditch diverts flows from the river at Young's Point, about 7,000 feet upstream from Horn Lane. The decree allotted 62.5 cfs to the SVID at this diversion. However, this was later reduced by SWRCB to 43 cfs. Historically and at present, there are significant losses along this ditch.

The Scott River Decree also allots water to USFS for instream use for fish and wildlife within the Klamath National Forest. These water rights are equal in priority to rights allotted other water users from diversion no. 576 to the USGS gaging station (no. 11519500, near Fort Jones). However, USFS water rights are inferior to all rights granted above diversion no. 576, which is most of the Scott Valley and its tributaries. Streamflow records show that in most years USFS does not receive its full allotment of water during the summer and fall months (DWR, 1991).

The Scott River Decree defines a zone of interconnected groundwater; within this zone, water pumped from the ground is considered to be part of the adjudicated water supply (DWR, 1991). However, the interconnected zone was designated with limited available information and does not fully account for the interconnectedness of the Groundwater Basin with river and streamflow. Further, the rights pertaining to groundwater use within the interconnected zone are not quantified: the decree states that the volume of water allotted to each individual is the amount "reasonably required to irrigate the acreage shown opposite their names" (Naman, 2005).

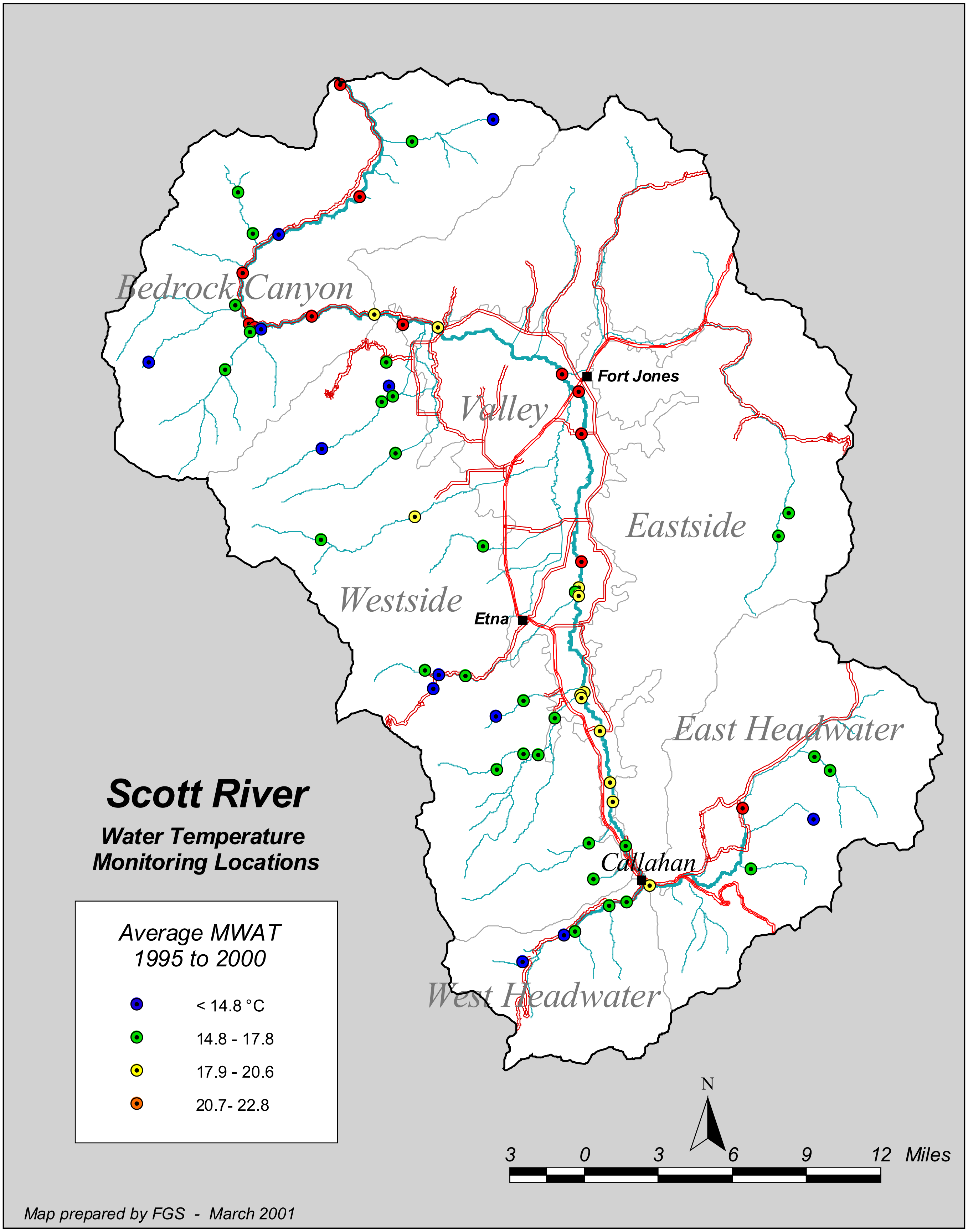
Water Quality

As identified by NCRWQCB (2006a), the principal water quality issues in the Program Area concern temperature and sedimentation. These issues fall under the category of non-point source (NPS) pollution. NPS pollution arises from many sources, including agriculture, timber harvesting, mine drainage, and residential developments, and is usually mobilized by excess precipitation (i.e., rainfall and snowmelt runoff) or irrigation water moving over and through the ground.

Temperature. In 1994, a cooperative effort, involving both public and private entities, was initiated to collect water temperature data in the Program Area. **Figure 3.2-11**, as taken from Quigley et al. (2001), shows the five-year average Maximum Weekly Average Temperatures (MWAT) resulting from this cooperative effort. The mainstem of the Scott River was found to have excessive summer water temperature levels. However, evidence suggests that this may have been true for the past several decades. The MWAT water temperatures recorded between 1997 and 2000 in all geomorphic sub-basins[5] were comparable to the range of temperatures recorded in the Scott River watershed since 1951 (Quigley et al., 2001). However, aside from the range of temperatures, the inability to compare potential differences in the persistence of excessive temperatures throughout the course of a year (or multiple years), tempers the above comparison and precludes any conclusions regarding the similarity of the historic and current stream temperature regime. Regardless, while much of the mainstem Scott River may have historically experienced excessive temperature levels, many of the tributary reaches had temperatures believed by Quigley et al. (2001) to be acceptable for salmonid rearing over the summer.

Sediment. The production and transport of sediment in the Program Area depends in part on natural conditions such as climate, geology and episodic events including fires and floods. In addition, as discussed above, past and present land-use and management practices have increased sediment yield in certain parts of the watershed. Records of sediment-related problems can be traced back to the placer and hydraulic mining era of the late 1800s. Gold dredging near Callahan in the 1930s and 1940s created chronic turbidity and siltation problems (SRWC, 2006). More recently, Sommarstrom et al. (1990) demonstrated that a significant source of sediment is the highly erodible, decomposed granite soils on the western slopes of the Program Area; erosion from these soils has been greatly accelerated by road building.

5 Quigley et al. (2001) divided the Scott River watershed into six geomorphic sub-basins: East Headwaters, West Headwaters, Eastside, Westside, Valley, and Canyon.



SOURCE: Quigley et al. (2001)

Figure 3.2-11
Scott River Watershed Water Temperatures

Of particular concern are excessive percentages of silt, sand, and fine gravel (i.e., particles less than 0.0625 mm and up to 6.3 mm). Excessive percentages of sediment 6.3 mm and finer cause problems for fish by smothering eggs and aquatic invertebrates, the burial of bottom cover, reductions in the volume and number of pools for rearing, and, through the loss of deep, cool water pools, may result in local increases in ambient stream temperatures. Sediment levels have been measured in spawning gravels in the Scott River in 1989 and 2000, and in French, Etna, and Sugar Creeks in 1982, 1989, and 2000 (Sommarstrom et al., 1990; Sommarstrom, 2001). Lester (1999, in NCRWQCB, 2005) also analyzed sediments in Canyon Creek and Tompkins Creek. Only a few sections of the mainstem Scott River (near Fort Jones) currently have fines above the NMFS recommended level of 12 percent, and these levels have shown a reduction from 1989 to 2000 according to Sommarstrom (2001). Etna Creek and lower French Creek showed reduced levels also, but the upper French Creek and Sugar Creek sites showed a slight increase (SRWC, 2006). Data collected by USFS in cooperation with the French Creek Watershed Advisory Group (WAG) showed a decreasing trend in the level of fine sediment in pools over the 1992 to 2001 time period. Over this time period, the French Creek WAG began to implement a road-related sediment reduction plan and the data suggest the plan has been effective.

In general, most of the sediment data collected indicate improving conditions (from 1989 to 2000) with regards to sediment less than 0.85 mm, but exhibit no clear trend with regard to sediment in the 0.85-6.3 mm size range. The mainstem Scott River appears to be getting coarser in its sediment composition, particularly in the mid-section of the Valley downstream of Highway 3 (SRWC, 2006). This reduction in fine sediment may reflect the readjustment of the river’s gradient after the removal of a small diversion dam, and its 30-year accumulation of sediment, near Moffett Creek sometime between 1987 and 1989 (SRWC, 2006). Still, accumulations of sand-sized sediment in some of the lower gradient reaches of the Scott River Valley continue to be elevated above levels that would be suitable for high quality salmonid spawning and rearing habitat.

The Impact of Diversions on Flow Volume and Water Quality

As discussed above, agricultural water diversions have led to decreased surface flows in the spring and summer months, thereby reducing the amount of instream habitat and locally increasing ambient surface water temperatures. As part of the Program, CDFG would authorize the take of coho salmon that might occur incidental to diverting and using water pursuant to and in accordance with a valid water right (ITP Covered Activity 1). All water diversions the Program would cover are existing, ongoing diversions, both active and passive. NCRWQCB (2005) has concluded that elevated temperatures and excessive amounts of sediment contribute to the non-attainment of beneficial uses associated with the cold-water fishery, namely the salmonid fishery. This is the existing condition within the Program Area. Over time, the persistence of low baseflow volumes can exert an effect over an increasingly larger area, such as adversely affecting the condition of the riparian corridor (e.g., lowering the streamside water table, loss of stabilizing vegetation, and subsequent increased rates of bank erosion and channel incision during high-flow periods). These effects can be further exacerbated by an increase in the rate of water diversion or extraction.

Implementation of the Program would not cause Agricultural Operators to increase their surface water diversions or increase the amount of water they are entitled to divert. To the contrary, the Program, by means of a number of required measures, would provide a mechanism to verify, monitor, and control the diversion and use of water within the Program Area to ensure that such diversion and use is based on a valid water right.

Lower Scott River (Canyon Reach)

The mainstem Scott River, in the gorge section between the downstream end of the Scott Valley and the Klamath River, is comparatively steep and high energy. Sediment is only locally stored and riffle forms are common. The shape of the 1914 profile is different from many of the other Klamath River tributaries, containing a concave-up section from the mouth upriver to RM 16 and flattening into its valley about 21 miles upriver (Ayres and Associates, 1999). The slope of the river from the mouth to about RM 7.6 is 36.4 ft/mi (0.0069 ft/ft) and steepens greatly to 60.7 ft/mi (0.0115 ft/ft) from RM 6.6 to about RM 21. A substantial portion of this steepness is accumulated in the steep drop below Boulder Creek (RM 16). The channel slope flattens significantly in Scott Valley. The average channel slope in the valley from RM 21 to RM 32 is about 7.4 ft/mi (0.0014 ft/ft).

Eastern Headwaters (East Fork of Scott River)

The East Fork and South Fork of the Scott River converge at the town of Callahan to form the headwaters of the Scott River mainstem. The East Fork drains out of the Scott Mountains and has a total watershed area of 113.5 square miles (14 percent of the Program Area). Elevations in this drainage range from 2,720 feet amsl at Callahan to 8,540 feet amsl at China Mountain. The steep, rugged mountains of the East Fork Scott River sub-basin are composed of both sedimentary and metamorphic bedrock types, as well as large areas of mafic bedrock and a little granitic bedrock. One upland valley has Quaternary age glacial deposits (SQRCD, 2005). The sub-watershed is generally characterized by a low frequency of landslides (NCRWQCB, 2005).

The headwater tributaries in the East Fork Scott River sub-basin are generally small, steep, high gradient streams. These high gradient streams flow into narrow alluvial channels of low gradient, moderately confined valley bottoms which, in turn, are bordered by discontinuous alluvial floodplains. Grazing and development of levees from bed material and tailings have prevented continuous riparian development. Furthermore, channel confinement due to levee development has caused channel down-cutting. The down-cutting has caused many alders to die as they were separated from streamflow (SQRCD, 2005). Overall, channel geomorphology has been affected by downcutting and straightening, as well as steepening of channel gradient caused by mining and mining tailings (SQRCD, 2005). Levees and the loss of riparian vegetation have also contributed to channel incision and less hydrologic connection to the floodplain. Channel geomorphology has been simplified over native conditions.

Streamflow data in the East Fork drainage was collected by USGS for WY 1960 to 1974 and, more recently, by DWR beginning in 2002. These data show average August and September flows to be approximately 5 cfs and 3 cfs, respectively. Stream temperature data have been collected for the

East Fork and two tributaries since 1996. Summer temperatures in the tributaries have ranged from 12-18°C (53.6-64.4 °F), while temperatures in the East Fork have ranged from 19-22.7 °C (66.2-72.9 °F) (refer to Chapter 3.3 for discussion of salmonid temperature requirements).

Agricultural activity in the East Fork includes mountain range grazing in the summer and fall and pasture production in the alluvial valleys (SQRCD, 2005). Stream diversion is accomplished using both gravel push-up dams and hand stacked rock and cobble diversion structures and most of the irrigated pasture is flood irrigated using water from the East Fork and its tributaries. Allocated diversion volumes for the East Fork are shown in Table 3.2-2; refer to Chapter 3.1 for estimates of existing diversion volumes.

Western Headwaters (South Fork of Scott River)

The South Fork of the Scott River drains out of the Salmon Mountains in the southwest portion of the Scott Valley and has a total watershed area of 39.3 square miles (5 percent of the Program Area). Elevations in this drainage range from 3,120 feet amsl near Callahan to 7,400 feet amsl at the Scott River/Salmon River drainage divide. The South Fork Scott River originates in steep, rugged mountains consisting of largely granitic and mafic bedrock with small amounts of sedimentary and metamorphic bedrock. The South Fork sub-watershed has experienced significant landslide delivery, of which about 60 percent is anthropogenic (NCRWQCB, 2005). The largest anthropogenic contribution is from past mining activity on mafic bedrock along Slide Creek (SQRCD, 2005). Several channels suffer from the legacy effects of hydraulic mining.

As Quigley et al. (2001) describe, the morphological characteristics of this drainage include steep headwater tributaries that are generally small, low-order and high gradient streams. Snow accumulation and runoff significantly influence streamflows, which move quickly through steep reaches to the lower gradient Scott River. Tailings from historic mining activities dominate the narrow valley and have so completely altered channel processes and geomorphic and hydrologic function that recovery of the stream will not occur without human intervention (SQRCD, 2005). Historical mining may also have destroyed historical side channels and backwater areas.

Streamflow data in the South Fork drainage was collected by USGS for WY 1959 and 1960 and, more recently, by DWR beginning in 2002. These data show a wide variation in average summer flows, ranging between 12 cfs and 2 cfs for the months of August and September. Stream temperature data has been collected at two locations since 1996. Summer temperatures in the South Fork range from 15-17 °C (59-63 °F) and temperature conditions are generally favorable for salmonids during the summer (SQRCD, 2005).

Limited agricultural activity in the South Fork includes mountain range grazing in the summer and fall and pasture production (SQRCD, 2005). Stream diversion is accomplished using both gravel push-up dams and hand stacked rock and cobble diversion structures and most of the irrigated pasture is flood irrigated using water from the South Fork and its tributaries. Allocated diversion volumes for the South Fork are shown in Table 3.2-2. There are six active diversions in the South Fork drainage allotted a combined, adjudicated diversion rate near 16 cfs. An estimated maximum of 20 cfs (allowed in the Scott River Decree through utilization of the 30-day average provision) is diverted from these active diversions in the South Fork drainage during the spring; this volume reduces to less than 7 cfs in the late summer (SQRCD, 2005).

Sugar Creek and Wildcat Creek

Sugar Creek and Wildcat Creek are neighboring streams located in the southwestern portion of the Program Area. Both of these streams emerge from the Salmon Mountains and drain relatively small watersheds (Sugar Creek, 13.9 square miles; Wildcat Creek, 7.3 square miles) on the west side of the Valley; they empty into the Scott River a few miles downstream from the confluence of the East and South Forks. Elevations in these drainages range from 3,000 feet amsl at their confluence with the Scott River to over 7,000 feet amsl in their headwater areas. Both of these streams are distinct from many of the other, larger western tributaries in that they tend to remain connected to the Scott River during years of average precipitation and runoff conditions (SQRCD, 2005).

The lower section of both streams is heavily impacted by tailings piles (SQRCD, 2005). There are few side channels and backwater areas in Sugar Creek, and Wildcat Creek has several areas where side channels and backwaters exist but the tailings limit floodplain access and potential side channel development. Sugar Creek shows indications of carrying excessive fine sediments, mostly derived from large watershed areas underlain by decomposed granite. The excessive amount of fine sediment in the channel may originate from erosion caused by historic diversion ditch failures as well as from sediment delivery from abandoned USFS roads higher in the watershed (SQRCD, 2005). The lower two miles of the channel contain adequately sorted gravel bed materials. Above this area, the channel is dominated by bedrock and a mixture of cobbles and boulders (SQRCD, 2005).

Streamflow data for Sugar Creek was collected by USGS for WY 1958 to 1960 and, more recently, by SQRCD beginning in 2002. No current flow data exists for Wildcat Creek. The data for Sugar Creek indicate that summer baseflows range from 1 to 3 cfs; SQRCD (2005) suggests that summer baseflows in Wildcat Creek are likely less than 1 cfs near its mouth. Stream temperatures have been monitored in both creeks since 1998. Summer temperatures in both creeks range from 15-17 °C (59-63 °F) (SQRCD, 2005).

Agricultural activity in both the Sugar Creek and Wildcat Creek drainages is limited to mid- and lower-stream sections. The principal method of stream diversion is to use hand stacked rock and cobble diversion structures. Allocated diversion volumes for Sugar Creek and Wildcat Creek are shown in Table 3.2-2; refer to Chapter 3.1 for estimates of existing diversion volumes.

French Creek (including Miners Creek)

French Creek drains from the eastern slope of the Salmon Mountains in the southwestern part of the Program Area; it has a drainage area of approximately 44.7 square miles (six percent of the Program Area). Elevations in this drainage range from 2,950 feet to 7,400 feet amsl. Unlike many other tributaries in the Program Area (except for Sugar Creek), the French Creek drainage includes a large area underlain by granitic and dioritic rocks, which make up about half of the total area. At the mid- to lower-elevations, soils derived from these rock formations, particularly the granite, tend to be very susceptible to erosion by overland flow. An earlier study (Sommarstrom et al., 1990) showed that over 23 percent of the annual total erosion within the Scott River watershed originated from the French Creek drainage and, of this fraction, almost 60 percent was due to upland land management activities (such as roads and skid trails). However, improvement of upland roads and their drainage systems over the past 15 years has resulted in improved fine sediment levels in French Creek (SQRCD, 2005).

The majority of French Creek and its tributaries are high energy streams that efficiently transport sediment to the lower energy stream reaches further downstream. In spite of the relatively high sediment loads carried by most west side tributaries (Sommarstrom, et al., 1990), their generally steep gradients through the mid- to upper-reaches allow them to transport most or all of the granitic sands supplied to them from both natural and accelerated (human-caused) watershed erosion processes. However, once within the lower gradient valley bottoms, the stream energy decreases and sediment is deposited.

Upper Miners Creek presently flows through a mountain meadow composed of alluvial sediment deposits. Portions of the channel are defined and controlled by exposures of the granitic bedrock. The stream is deeply incised and well confined, and the banks are composed of unconsolidated coarse-to-fine soils. The stream banks are steep and unstable and the channel in this section is thought to be a significant source for fine sediment to downstream areas (Sommarstrom et al., 1990).

Stream temperature data have been collected annually in French Creek since 1997. Temperatures in the upper reaches (above the confluence with Miners Creek) generally do not exceed 16-18 °C (61-64 °F) during the summer, while temperatures downstream of the confluence with Miners Creek can reach as high as 20 °C (68 °F) (SQRCD, 2005).

Agricultural activity in the French Creek and Miners Creek drainages includes summer grazing, irrigated crop, and pasture production, the latter being most prevalent. The principal method of stream diversion is to use bolder vortex weirs and most of the irrigated pasture is flood irrigated.

Allocated diversion volumes for French Creek and Miners Creek are shown in Table 3.2-3; refer to Chapter 3.1 for estimates of existing diversion volumes.

French Creek Decree (1958). Stream diversion from French Creek (including Miners Creek) is defined by the French Creek Decree and administered by the Siskiyou County Superior Court. The decree allots a total of 36.5 cfs from French Creek and its tributaries. The decree is watermastered by DWR and diversion volumes and the history of diversion is better documented in French Creek than any other stream in the Scott River watershed (SQRCD, 2005). The irrigation season, as identified in the decree, begins April 1 and continues to September 30, with reduced diversions during the remainder of the year for domestic, stock water, and other beneficial uses (beneficial uses related to domestic and agricultural water supplies are summarized below, 3.2.3 Regulatory Setting).

Westside Tributaries (Etna Creek, Patterson Creek, Kidder Creek, and Big Slough)

The Marble Mountains, to the west of Scott Valley, are the source of several large, perennial streams, namely Etna Creek, Patterson Creek, and Kidder Creek. These streams are similarly aligned, flowing in a northeasterly direction. Collectively, elevations in these drainages range from 2,800 feet to greater than 7,500 feet amsl. Big Slough is the name given to the sinuous stretch of river from the confluence of Patterson and Johnson Creeks downstream to the confluence with Kidder Creek; the reach extending from the confluence of Big Slough and Kidder Creek downstream to the Scott River is herein designated as Lower Kidder Creek.

Generally, morphological characteristics of this area include steep headwater tributaries that are typically small, low-order, high-gradient streams which drain to lower elevations and lower gradient stream reaches on the valley floor. Stream flows are greatly influenced by snow accumulations and snowmelt runoff, which transports quickly through steep stream reaches and then slows as it reaches the lower gradient valley reaches. Large alluvial fans, comprised mostly of gravels and cobbles, have been deposited by Etna Creek, Patterson Creek, and Kidder Creek in their lower reaches; the most permeable known sediments along the western mountain front are found in the large gravelly fans deposited by West Patterson, Kidder, Etna, and Shackleford Creeks, and in the stream channels, both currently active and abandoned (buried), which radiate downslope from the fanhead areas (Mack, 1958). As a result, in the summer months surface flows typically decrease to the point that they sink into the fans and become subsurface flow. Throughout the summer, these streams are typically dry in their lower reaches near Highway 3.

Aside from the alluvial floodplains of the Scott River, another important storage area for sediments in the valley is in the vicinity of Big Slough. Big Slough parallels the Scott River and drains the tributaries north of Etna Creek, including Johnson, Crystal, and Patterson Creeks. It then combines with Kidder Creek, forming Lower Kidder Creek, before flowing into the Scott River. This narrow, shallow channel becomes very sinuous above the confluence with Patterson Creek and experiences frequent overbank flows and ponding (McCreary Koretsky Engineers, 1967 in Sommarstrom et al., 1990). As a result, this drainage probably deposits much of its annual sediment load over its floodplain (Sommarstrom et al., 1990). Big Slough and Lower Kidder Creek possess slough-like characteristics, including a flat gradient, side channels, high sinuosity, and backwater areas. Big Slough and Lower Kidder Creek stop flowing by early August but pools usually remain (SQRCD, 2005).

Unlike their upstream tributaries, Big Slough and Lower Kidder Creek flow in an almost due north direction. An early study of the Scott Valley described why the tributaries in this area flow north and also provided further evidence of sediment deposition in the valley over geologic time:

> During flood stages, the Scott River has apparently built up broad, low natural levees sloping gently away from the channel banks toward the valley margins. The natural levee along its west side prevents the western tributary streams from entering the Scott River via the shortest distance, directly to the east. The phenomenon of deferred tributary junction has thus resulted, because the combined drainage of the western streams has been forced to flow northward

> parallel to the Scott River for several miles within the confines of the slough between the area of higher fans to the west and the natural levee to the east. (Mack, 1958)

Big Slough marks the widest extent of the Scott River Valley Groundwater Basin mapped by DWR (2004).

Flow data are sporadic for these tributaries and no long-term record exists for any particular stream. Flow data for Etna Creek were collected by USGS for WY 1962 to 1972. The U.S. Fish and Wildlife Service (USFWS) has collected flow data on Kidder Creek since September 2002. Currently, flow data are not collected for Patterson Creek. Based on available data and estimates made by SQRCD (2005), summer baseflows (upstream of all diversions) for these channels ranges from 0.2 to 8 cfs. Flow volumes for Big Slough and Lower Kidder are unknown.

Temperature data have been collected annually since 1997 in reaches above the alluvial sections of Etna, Patterson, and Kidder Creek. Summer stream temperatures in upper Etna Creek range from 14-15 °C (53-59 °F), while temperatures at the mouth range from 18-20 °C (64-68 °F). In Patterson Creek (upstream of Highway 3), summer stream temperatures average 17.4 °C (63 °F). Summer stream temperatures in Kidder Creek (upstream of Greenview) range from 16-19 °C (61-66 °F). There are no temperature data for Big Slough and Lower Kidder Creek, but temperatures in these streams are thought to exceed the tolerance level for salmonids prior to going dry in early August (SQRCD, 2005).

Allocated diversion volumes for the westside tributaries are shown in Table 3.2-2; refer to Chapter 3.1 for estimates of existing diversion volumes. Stream diversion is accomplished using bolder vortex weirs, gravel push-up dams, and hand stacked rock and cobble diversion structures.

Shackleford Creek (including Mill Creek)

Shackleford Creek (including Mill Creek) drains a portion of the Marble Mountains and has a total watershed area of approximately 50 square miles (six percent of the Program Area). Elevations in this drainage range from 2,880 feet amsl in the Quartz Valley to over 8,000 feet amsl in the Marble Mountains.

Morphological characteristics of the Shackleford Creek watershed are comparable to those of other westside tributaries described above. Channels within this watershed include steep headwater tributaries that are generally small, low-order, high gradient streams that drain to lower elevation, lower gradient stream reaches at the valley floor. Shackleford and Mill Creeks have alluvial fans at the base of the Canyon reach where the gradient flattens and channels emerge onto the floor of Quartz Valley and the main Scott River Valley. This scenario is consistent with the alluvial fans of Etna, Patterson and Kidder Creeks (as described above), where winter flows drop most of their coarse sediment load on the upper and middle alluvial fan surface and summer flows go subsurface.

Stream flows from this sub-watershed are greatly influenced by snow accumulations and snowmelt runoff, which transports flow and sediment quickly through steep stream reaches until flows reach the lower gradient valley and alluvial fan surfaces. Before emerging onto the fan apex, the tributary stream channels are bordered by discontinuous alluvial floodplains in their lower valley reaches. Alluvial fans located at the base of the valley floor are large. The alluvial fans of both streams have poor riparian vegetation densities, likely due to the fluctuating water table (a natural phenomenon) (SQRCD, 2005) and the natural tendency for channels dissecting the fan surfaces to maintain a laterally dynamic state. The channel is somewhat unstable, which prevents the development of persistent pools. In the areas at and above the apex of the alluvial fans, Shackleford Creek and Mill Creek possess numerous side-channel and backwater habitats.

Long-term flow records are lacking for the Shackleford Creek watershed. USGS collected flow data from WY 1957 to 1960 for Shackleford Creek near Mugginsville. More recently, flow data have been collected by DWR and USFWS at three stations since 2002. Flow data collected (by USFWS) upstream of diversions indicate that September baseflows in the Shackleford Creek watershed range from 2 to 13 cfs. Stream temperatures have not been monitored long-term in the lower, alluvial reaches of the watershed. However, data collected in 2003 and 2004 indicate that lower Shackleford Creek can reach temperatures as high as 21 °C (70 °F) during peak summer months (SQRCD, 2005).

Agricultural activity in the Shackleford Creek watershed includes livestock production, dry-land grazing, and irrigated crop and pasture production (SQRCD, 2005). Pasture production is the main activity and flood irrigation is the principal method of irrigating. Stream diversion is accomplished using both bolder vortex weirs and hand stacked rock and cobble diversion structures. Allocated diversion volumes for Shackleford Creek and Mill Creek are shown in Table 3.2-4; refer to Chapter 3.1 for estimates of existing diversion volumes.

Shackleford/Mill Creek Decree (1950). Stream diversion from Shackleford Creek is defined by the Shackleford Creek Decree and administered by the Siskiyou County Superior Court. This decree covers Shackleford Creek and all tributaries (including Mill Creek) and springs draining to Shackleford Creek. The decree allots a total of 69.55 cfs from Shackleford Creek and its tributaries. Since 1967, this decree has been watermastered by DWR. Irrigation season under the decree begins on April 1 and continues through October 31.

Eastside Tributaries (Moffett Creek)

The eastside of the Scott Valley is dominated by generally dry foothills extending north from the Scott Mountains (Quigley et al., 2001), and elevations range from 2,700 to over 6,000 feet amsl. Moffett Creek is the largest of the eastside tributary streams, having a watershed area of approximately 233 square miles (28 percent of the Program Area), yet it experiences the lowest annual precipitation. The watershed is underlain by mostly sedimentary and metamorphic bedrock, with a little mafic bedrock in the mountains and extensive fills of Quaternary age in the main stream valley. No significant landslides were mapped or observed on aerial reconnaissance of Moffett Creek watershed (NCRWQCB, 2005). The Moffett Creek watershed can be subdivided into two general sub-watersheds, the Lower Moffett Creek watershed and the Upper Moffett Creek watershed (SHN, 2003).

The Upper Moffett Creek watershed consists of a generally broad, north trending, low gradient valley that is occupied by the mainstem of Moffett Creek (SHN, 2003). Steep ridge and swale topography extend down to the valley floor from ridge crests as high as 3,000 feet amsl. These steep swales contain ephemeral tributaries. Located at the toe of these swales, at the confluence with the principle streams, are alluvial fans that extend into the Moffett Creek valley. These fans appear to have developed as a result of loose, non-cohesive soils being mobilized and deposited by high energy, episodic flow events (debris flows) associated with summer thunderstorms or other flood events (SHN, 2003). There is a distinct stepped pattern in the channel morphology as a result of the development of these naturally occurring alluvial fans (SHN, 2003).

Continuous flow records for Moffett Creek are limited to data collected by USGS from WY 1960 to 1967. Tributary streams within the eastside area are typically short, drain rapidly, and tend to flow seasonally (ephemeral or intermittent). Moffett Creek and some of its upper headwater tributaries are the only streams which usually flow year round (Quigley et al., 2001).

The majority of the watershed is in private ownership except for McAdams Creek, where USFS (Klamath National Forest) is the principal landowner. Timber production with seasonal livestock grazing is the primary land use in the upland areas. Water diversions for irrigation are limited to the period from April 1 to "about" October 15. In the upper reaches where perennial flow persists, gravity diversion dams and pumps can be used to divert water for irrigation, but wells are required in the lower watershed because surface flow subsides early in the summer. Allocated diversion volumes for the Moffett Creek watershed are shown in Table 3.2-2 (schedules B27 through B32).

Conclusions Regarding Hydrologic and Geomorphic Setting for the Scott River Watershed

Past and present human activity and development have substantially altered the hydrologic and geomorphic conditions within the Program Area. The most important, and detrimental, changes and land management actions include: timber harvesting and road construction, fire suppression, beaver removal, mining and dredging operations, channel modification and flood control, and agricultural practices. The principal impacts of these human actions have been an altered channel structure, an altered flow regime, and an increased sediment load. Some of these impacts may be irreversible without aggressive restoration efforts (e.g., the extensive accumulations of cobbles and boulders from dredging and the subsequent implications for natural channel structure and process); others can be partially alleviated or even completely repaired in some cases (e.g., restoration of beaver populations, and repair of upland erosion sources such as old logging roads). Most of the lasting impacts observed today are the collective result of multiple actions and land management decisions, and it is often difficult to tease out the relative influence of any one particular action. Regardless, it is important to understand that historical or continuing practices such as beaver trapping, placer mining, flow regulation, and channel modification can affect contemporary river characteristics for decades, or longer.

3.2.2 Regulatory Setting

Federal and State Water Quality Policies

The statutes that govern the activities under the Program that affect water quality are the federal Clean Water Act (CWA) (33 U.S.C. § 1251) and the Porter-Cologne Water Quality Control Act (Porter-Cologne) (Water Code, § 13000 *et seq.*). These acts provide the basis for water quality regulation in the Program Area.

The California Legislature has assigned the primary responsibility to administer and enforce statutes for the protection and enhancement of water quality to SWRCB and its nine Regional Water Quality Control Boards (RWQCB). SWRCB provides state-level coordination of the water quality control program by establishing statewide policies and plans for the implementation of state and federal regulations. The nine RWQCBs throughout California adopt and implement water quality control plans that recognize the unique characteristics of each region with regard to natural water quality, actual and potential beneficial uses, and water quality problems. The RWQCB adopts and implements a Water Quality Control Plan (hereinafter Basin Plan) that designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for all waters addressed through the plan (California Water Code, §13240-13247).

Corps Permit and Water Quality Certification

CWA, section 404 requires a permit from the United States Army Corps of Engineers (Corps) prior to discharging dredged or fill material into waters of the United States, unless such a discharge is exempt from CWA section 404. The term “waters of the United States” as defined in the Code of Federal Regulations (40 CFR 230.3[s]) includes all navigable waters and their tributaries. In addition, section 401 of the CWA requires that an applicant for any federal permit (e.g., a Corps 404 permit) obtain certification from the state that the discharge will comply with other provisions of the CWA and with state water quality standards. For the Program Area, NCRWQCB or SWRCB (in the case of activities associated with water diversions) must provide the water quality certification required under section 401 of the CWA. It is up to the individual project proponent, in this case the sub-permittees and SQRCD, to contact the federal agency(s) in order to determine whether the federal agency(s) would take jurisdiction on a specific project and require a permit; if a federal permit is required then the project proponent would also be required to obtain water quality certification from NCRWQCB.

Beneficial Use and Clean Water Act, Section 303(d)

NCRWQCB is responsible for the protection of the beneficial uses of waters within Siskiyou County. NCRWQCB uses its planning, permitting, and enforcement authority to meet this responsibility and has adopted the Water Quality Control Plan for the North Coast Region (Basin Plan) to implement plans, policies, and provisions for water quality management. NCRWQCB published the most recent version of the Basin Plan in September 2006 (NCRWQCB, 2006b).

In accordance with state policy for water quality control, NCRWQCB employs a range of beneficial use definitions for surface waters, groundwater basins, marshes, and mudflats that serve as the basis for establishing water quality objectives and discharge conditions and prohibitions. The Basin Plan (NCRWQCB, 2006b) has identified existing and potential beneficial uses supported by the key surface water drainages throughout its jurisdiction. The beneficial uses designated in the Basin Plan for the water bodies relevant to the Program are identified in **Table 3.2-6**. The applicable beneficial use categories are defined in **Table 3.2-7**. The Basin Plan (NCRWQCB, 2006b) also includes water quality objectives that are protective of the identified beneficial uses.

TABLE 3.2-6
BENEFICIAL USES IN THE SCOTT RIVER HYDROLOGIC AREA

Waterbody	MUN[a]	AGR	IND	PRO	GWR	FRSH	NAV	POW	REC 1	REC 2	COMM	COLD	WILD	RARE	MIGR	SPWN	AQUA
Scott Bar Hydrologic Subarea	E	E	E	P	E	E	E	E	E	E	E	E	E	E	E	E	P
Scott Valley Hydrologic Subarea	E	E	E	P	E	E	E	E	E	E	E	E	E	E	E	E	E

E = existing beneficial use
P = potential beneficial use

[a] Refer to Table 3.2-7, below, for definition of abbreviations

SOURCE: NCRWQCB, 2006b

The objective of the federal CWA is “to restore and maintain the chemical, physical, and biological integrity of the nation’s waters.” Under CWA section 303(d), the State of California is required to develop a list of impaired water bodies that do not meet water quality standards and objectives. **Table 3.2-8** provides details of the listing of the Scott River as an impaired water body, as designated by NCRWQCB (2006a), including pollutants and issues of concern. For those water bodies failing to meet standards, states are required to establish total maximum daily loads (TMDL). A TMDL defines how much of a specific pollutant a given water body can tolerate and still meet relevant water quality standards. The Scott River has been listed as impaired because of sediment and temperature levels in excess of water quality standards described in the CWA or in the Basin Plan. The beneficial use most affected by excessive sediment and elevated temperature is the cold-water salmonid fishery (NCRWQCB, 2005).

The *Action Plan for the Scott River Watershed Sediment and Water Temperatures Total Maximum Daily Loads* was published in December 2005 (NCRWQCB, 2005). In general, this document identifies and describes causes of impairment, recommended levels for water temperature and sediment concentration, and an implementation plan.

TABLE 3.2-7
DEFINITIONS OF BENEFICIAL USES OF SURFACE WATERS

Beneficial Use	Description
Municipal and Domestic Supply (MUN)	Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.
Agricultural Supply (AGR)	Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.
Industrial Service Supply (IND)	Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well repressurization.
Industrial Process Supply (PRO)	Uses of water for industrial activities that depend primarily on water quality.
Groundwater Recharge (GWR)	Uses of water for natural or artificial recharge or groundwater for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.
Freshwater Replenishment (FRSH)	Uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).
Navigation (NAV)	Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.
Hydropower Generation (POW)	Uses of water for hydropower generation.
Water Contact Recreation (REC 1)	Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white-water activities, fishing, or use of natural hot springs.
Non-Contact Water Recreation (REC 2)	Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.
Commercial and Sport Fishing (COMM)	Uses of water for commercial, recreational (sport) collection of fish, shellfish, or other aquatic organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.
Cold Freshwater Habitat (COLD)	Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
Wildlife Habitat (WILD)	Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.
Rare, Threatened, or Endangered Species (RARE)	Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under State or federal laws as rare, threatened, or endangered.
Migration of Aquatic Organisms (MIGR)	Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.
Spawning, Reproduction, and/or Early Development (SPWN)	Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.
Aquaculture (AQUA)	Uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.

SOURCE: NCRWQCB (2006b)

TABLE 3.2-8
PROPOSED 2006 CWA, SECTION 303(D) LIST OF WATER QUALITY LIMITED SEGMENTS IN THE PROGRAM AREA

Name	Pollutant/Stressor	Source	TMDL Completion Date
Scott River	Sedimentation/Siltation	Irrigated Crop Production Pasture Grazing-Riparian and/or Upland Silviculture Resource Extraction Mill Tailings Natural Sources Nonpoint Source	Staff Report for the Action Plan published on December 7, 2005; USEPA approved TMDL in 2006
	Temperature	Irrigated Crop Production Pasture Grazing-Riparian and/or Upland Agricultural Return Flows Silviculture Flow Regulation/Modification Water Diversions Habitat Modificaton Removal of Riparian Vegetation Streambank Modification/ Destabilization Drainage/Filling of Wetlands Other Nonpoint Source	Staff Report for the Action Plan published on December 7, 2005; USEPA approved TMDL in 2006

SOURCE: NCRWQCB (2006a)

Water quality standards concerning temperature, turbidity, and sediment levels have been identified in the Basin Plan (NCRWQCB, 2006b). The standards stipulate that the natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of RWQCB that such alteration in temperature does not adversely affect beneficial uses, and at no time or place shall the temperature of any “cold” water be increased by more than 2.8°C (5 °F) above the natural receiving water temperature. Turbidity standards state that turbidity shall not increase more than 20 percent above naturally occurring background levels. Criteria for suspended material, settleable material, and sediment are narrative (i.e., standards are not based on numerical goals but, rather, are set to avoid nuisance levels and to maintain the designated beneficial uses of the river).

NPDES Program

The CWA was amended in 1972 to provide that the discharge of pollutants to waters of the United States from any point source is unlawful unless the discharge is in compliance with a National Pollutant Discharge Elimination System (NPDES) permit. The 1987 amendments to the CWA added section 402(p), which establishes a framework for regulating municipal and industrial storm water discharges under the NPDES Program. In November 1990, the U.S. Environmental Protection Agency (USEPA) published final regulations that establish storm water permit application requirements for discharges of storm water to waters of the United States from construction projects that encompass five or more acres of soil disturbance. Regulations (Phase II Rule) that became final on December 8, 1999, expanded the existing NPDES Program to address storm water discharges from construction sites that disturb land equal to or greater than one acre and less than five acres (small construction activity).

While federal regulations allow two permitting options for storm water discharges (individual permits and General Permits), SWRCB has chosen to adopt only one statewide General Permit at this time that would apply to all storm water discharges associated with construction activity.[6] This General Permit requires all dischargers where construction activity disturbs one acre or more, to:

- Develop and implement a Storm Water Pollution Prevention Plan (SWPPP) which specifies Best Management Practices (BMPs) that would prevent all construction pollutants from contacting storm water and with the intent of keeping all products of erosion from moving off site into receiving waters.
- Eliminate or reduce non-storm water discharges to storm sewer systems and other waters of the nation.
- Perform inspections of all BMPs.

This General Permit is implemented and enforced by the nine RWQCBs. NCRWQCB administers the stormwater permitting program in the section of Siskiyou County that includes the Program Area. Dischargers are required to submit a Notice of Intent (NOI) to obtain coverage under this General Permit and annual reports identifying deficiencies of the BMPs and how the deficiencies were corrected. Dischargers are responsible for notifying the relevant RWQCB of violations or incidents of non-compliance.

On August 19, 1999, SWRCB reissued the General Construction Storm Water Permit (Water Quality Order 99-08-DWQ, referred to as “General Permit”). In September 2000, a court decision directed SWRCB to modify the provisions of the General Permit to require permittees to implement specific sampling and analytical procedures to determine whether BMPs implemented on a construction site are: (1) preventing further impairment by sediment in storm waters discharged directly into waters listed as impaired for sediment or silt, and (2) preventing other pollutants, that are known or should be known by permittees to occur on construction sites and that are not visually detectable in storm water discharges, from causing or contributing to exceedances of water quality objectives. The monitoring provisions in the General Permit have been modified pursuant to the court order.

As part of the Program, if a Covered Activity performed at a single project location will disturb a total of one acre or more of land, then SQRCD or the Agricultural Operator performing the activity will be required to submit a NOI to SWRCB and obtain coverage under the General

[6] SWRCB Order No. 99-08-DWQ National Pollutant Discharge Elimination System General Permit No. CAS000002.

Permit. The preparation of a SWPPP would be required in accordance with the General Permit. The SWPPP would include, but not be limited to, relevant measures, conditions, and obligations already described as part of the Program which would reduce the impacts of construction activities on stormwater and receiving water quality and quantity.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Act (codified in the California Water Code, §13000 *et seq*.) is the basic water quality control law for California. As mentioned above, it is implemented by SWRCB and the nine RWQCBs. SWRCB establishes statewide policy for water quality control and provides oversight of RWQCBs' operations. RWQCBs have jurisdiction over specific geographic areas that are defined by watersheds. Siskiyou County is under the jurisdiction of NCRWQCB. In addition to other regulatory responsibilities, RWQCBs have the authority to conduct, order, and oversee investigation and cleanup where discharges or threatened discharges of waste to waters of the state[7] could cause pollution or nuisance, including impacts to public health and the environment.

Dredge/Fill Activities and Waste Discharge Requirements

Covered Program Activities that involve or are expected to involve dredge or fill, and discharge of waste, are subject to water quality certification under section 401of the CWA and/or waste discharge requirements under the Porter-Cologne Act. SWRCB's Division of Water Rights processes section 401 water quality certifications on projects that involve water diversions (California Code of Regulations, title 23, § 3855.). Chapter 4, Article 4 of the Porter-Cologne Act (California Water Code, § 13260-13274), states that persons discharging or proposing to discharge waste that could affect the quality of waters of the state (other than into a community sewer system) shall file a Report of Waste Discharge with the applicable RWQCB. For discharges directly to surface water (waters of the United States) an NPDES permit is required, which is issued under both state and federal law; for other types of discharges, such as waste discharges to land (e.g., spoils disposal and storage), erosion from soil disturbance, or discharges to waters of the state (such as isolated wetlands), Waste Discharge Requirements (WDRs) are required and are issued exclusively under state law. The WDR application process is generally the same as for CWA section 401 water quality certification, though in this case it does not matter whether the particular project is subject to federal regulation. The project proponent would contact NCRWQCB, who would determine whether WDRs or a waiver of WDRs is required.

State Regulation and Oversight of Water Rights

SWRCB regulates the diversion and use of water in California, in part by the issuance of permits and licenses. In general, under state law, a person may divert and use water under a riparian or appropriative right. A riparian right entitles the landowner to use a correlative share of the water flowing past his or her property. Riparian rights do not require permits, licenses, or government approval, but they apply only to the water which would naturally flow in the river (or stream or

7 "Waters of the state" are defined in the Porter-Cologne Act as "any surface water or groundwater, including saline waters, within the boundaries of the state." (Water Code, § 13050 (e).)

creek), and they may only be exercised on the property adjacent to the stream. Further, riparian rights do not entitle a water user to divert water to storage in a reservoir for use in the dry season or to use water on land outside of the watershed that comprises the diversion location. Riparian rights remain with the property when it changes hands, although parcels severed from the adjacent water source generally lose their right to the water.

An appropriative water right allocates a given rate and/or volume of water to a specific entity or user. In California, appropriative water rights are generally described as pre-1914 and post-1914 rights. For pre-1914 rights, water rights could be acquired simply by taking and beneficially using water, and also (e.g., after 1872) through establishing a priority of right by posting a notice of appropriation at the proposed point of diversion and recording the notice with the respective County Recorder (SWRCB, 1990). Regardless of the amount of water claimed in the original notice of appropriation or at the time diversion and use first began, the amount of water which can now be rightfully claimed under an appropriative right initiated prior to December of 1914 is essentially fixed by that amount which is being put to beneficial use. Persons diverting water under riparian or pre-1914 claims of right, with certain exceptions, are required to file a Statement of Water Diversion and Use with SWRCB (SWRCB, 1990).

For post-1914 appropriative rights, an application for appropriation of water is submitted to SWRCB, and SWRCB issues permits and/or licenses that govern the beneficial use and diversion and/or storage of water from surface streams, other surface bodies of water, or from subterranean streams flowing in known and definite channels. An appropriation of such water requires compliance with the provisions of Division 2, Part 2, of the California Water Code. Under post-1914 appropriation law, anyone intending to divert water from surface waters or subterranean streams, in order to 1) use on land which is not riparian to the source, 2) store in a reservoir for later use on either riparian or non-riparian lands, or 3) make use of water which would not naturally be in the source, must apply with SWRCB for a permit or small domestic use registration. Aside from the requested amount of water, an application, and the subsequent permit or license (if issued), typically specifies the purpose of use (e.g., irrigation, recreation, and fish and wildlife enhancement), the place of use, and the point(s) of diversion. In order for SWRCB to approve an application, unappropriated water must be available to supply the applicant (water in many streams, including the Scott River and its tributaries, has already been fully appropriated during the dry season of the year). Although pre- and post-1914 appropriative rights are similar, post-1914 rights are subject to a much greater degree of scrutiny and regulation by SWRCB. Riparian rights, which usually are inherent in ownership of parcels that border or span streams and rivers, still have a higher priority than appropriative rights. In order for an appropriative or riparian claim to ripen into a prescriptive right, the use must be continuous and uninterrupted for a period of five years (SWRCB, 1990).

In certain cases, use of water does not require an appropriative water right permit or a small domestic use registration. SWRCB does not have permitting authority over the use of groundwater unless it is the underflow of a surface stream, flowing in a subterranean stream with a known and definite channel or otherwise legally (that is, as designated by the California

Legislature or SWRCB) determined to be directly connected to surface streams. [8] Further, a permit is not required for the proper exercise of a riparian right or the diversion of surface water under pre-1914 claims of right. However, as mentioned above, diverters are required to file a Statement of Water Diversion and Use with SWRCB.[9]

In particular circumstances (e.g., when stream systems have a proportionately large amount of diversions, or the system is seemingly over-allocated and the priority of right among diverters is in question or disputed), SWRCB may determine all rights to water in a given stream system whether based upon appropriation, riparian right, or other basis of right. The process is referred to as a statutory adjudication. The process is initiated by one or more claimants (diverters) filing a petition with SWRCB requesting a determination of the rights of the various claimants to the water of a given stream system. SWRCB then determines whether or not such a determination of rights is warranted and, if so, grants the petition, completes its investigations, and prepares a report describing the water supply and abstracting the claim of water right of each claimant. After SWRCB hears any objections to the report, it adopts an order of determination and files it with the court, along with other information. The court then sets a time for hearing, and after the hearing enters a decree that must set forth the priority, amount, season of use, purpose of use, point of diversion, and place of use of the water. Further, with respect to water used for irrigation, the decree must declare the parcels of land to which the water applies.

Water Rights Changes (California Water Code, § 1707). California Water Code, § 1707 authorizes any person entitled to the use of water to petition SWRCB for a change to the person's existing water right for purposes of preserving or enhancing wetlands habitat, fish and wildlife resources, or recreation in or on the water.

Applicable Local/County Regulations

Siskiyou County General Plan

The Conservation Element of the Siskiyou County General Plan (Siskiyou County, 1973) includes some general objectives relating to hydrology, water resources, and water quality. These objectives include:

- To preserve and maintain streams, lakes and forest open space as a means of providing natural habitat for species of wildlife;
- To preserve the quality of existing water supply in Siskiyou County and adequately plan for the expansion and retention of valuable water supplies for future generations and to provide for a comprehensive program for sustained multiple use of watershed lands through reduction of fire hazards, erosion control and type-conversion of vegetation where desirable and feasible.

8 As used in this chapter with respect to the Scott River in Siskiyou County, "stream system" includes groundwater within the "interconnected zone."
9 See California Water Code, § 5101.

3.2.3 Impacts and Mitigation Measures

Significance Criteria

Significance criteria, or thresholds, listed in Appendix G in the California Environmental Quality Act (CEQA) *Guidelines* may be used to determine the significance of a project's potential impacts. Additional (or more specific) criteria and objectives derived from other agencies or documents (e.g., NCRWQCB water quality standards), and determined to be appropriate based on Program-specific considerations, have also been incorporated within the context of Appendix G.

Some of the criteria listed in Appendix G of the CEQA *Guidelines* are not applicable to the Program or otherwise do not merit further discussion. Specifically, the Program is not anticipated to have a potentially significant impact in regard to some of the flood-related criteria in Appendix G. These criteria include exceeding the capacity of stormwater drainage systems, placing housing within a flood hazard area, or exposing people or structures to significant risk of loss, injury, or death involving flooding. Furthermore, the Program Area is not subject to inundation by seiche or tsunami, or mudflow. The significance criteria addressed above are not discussed further in this Draft EIR. The significance criteria in Appendix G that are pertinent to the Program, as well as applicable water quality objectives identified by NCRWQCB (2006b), are listed below. Using these criteria, a project or program would normally result in a significant hydrology- and water quality-related impact if it would:

Water Quality

- Cause or contribute to violations of ambient water quality objectives by substantially 1) increasing turbidity more than 20 percent above naturally occurring background levels and, 2) altering the ambient temperature of receiving waters such that one or more beneficial uses are adversely affected.

- Otherwise substantially degrade water quality or provide substantial additional sources of polluted runoff, including degradation of stream or river characteristics related to cold freshwater habitat.

Groundwater

- Substantially deplete groundwater supplies or interfere with groundwater recharge.

Surface Water Drainages

- Substantially alter erosion and/or sedimentation rates through increases or decreases in flow and/or sediment supply.

Flooding

- Substantially impede or redirect flood flows.

In addition to these considerations, the reader is referred to the discussion of existing conditions, significance criteria, and potential impacts contained in Chapter 3.3, Impact 3.3-1.

Impact Analysis

Impact 3.2-1: Certain construction activities performed under the Program could result in increased erosion and sedimentation and/or pollutant (e.g., fuels and lubricants) loading to surface waterways, which could increase turbidity, suspended solids, settleable solids, or otherwise decrease water quality in surface waterways (Significant).

Construction activities associated with the Program could increase the turbidity or otherwise degrade the water quality of receiving channels and waterways. This is a potentially significant impact. Activities that disturb ground within the floodplain, banks, or bed of a channel could make soils and sediments more susceptible to erosion. Increased erosion rates would likely lead to increased sediment concentrations and turbidity levels in the receiving channel(s) and to the subsequent degradation of aquatic habitats. Also, moderate increases in runoff from construction areas could initiate or exacerbate an erosion and sediment delivery problem. An increase in the runoff rate from the construction area may result from temporarily decreasing the resistance to overland flow (e.g., clearing of native vegetation or on-slope grading), decreasing the infiltration capacity of the soil through compaction, and/or by increasing the velocity of runoff (e.g., concentrating flow into manmade features or into existing rills or gullies). Further, if construction equipment or workers inadvertently release pollutants (e.g., hydraulic fluid or petroleum) on site, these compounds could be entrained by runoff and discharged into receiving channel(s) causing water quality degradation. The extent of erosion or pollution that could occur at any given project site varies depending on soil type, vegetation/cover, and weather conditions.

Most of the Covered Activities and proposed mitigation measures that would require construction involve short-term (i.e., within a single season) construction activities, and thus the associated potential impacts would be temporary in nature. Covered Activities and measures that include notable construction components include maintenance, installation, and removal of water diversion structures; installation and maintenance of fish screens; construction and maintenance of stream crossings; riparian restoration and revegetation; installation, maintenance, and repair of instream structures; and barrier removal projects including fish ladder and boulder weir installations; and channel restoration projects. Specific construction activities referenced under this potential impact include, but are not limited to, use of heavy machinery including loaders and backhoes within and near the channels, shallow excavation within and near the channels, moving bed material within the channels, and establishing and grading staging areas for equipment, machinery, and vehicles.

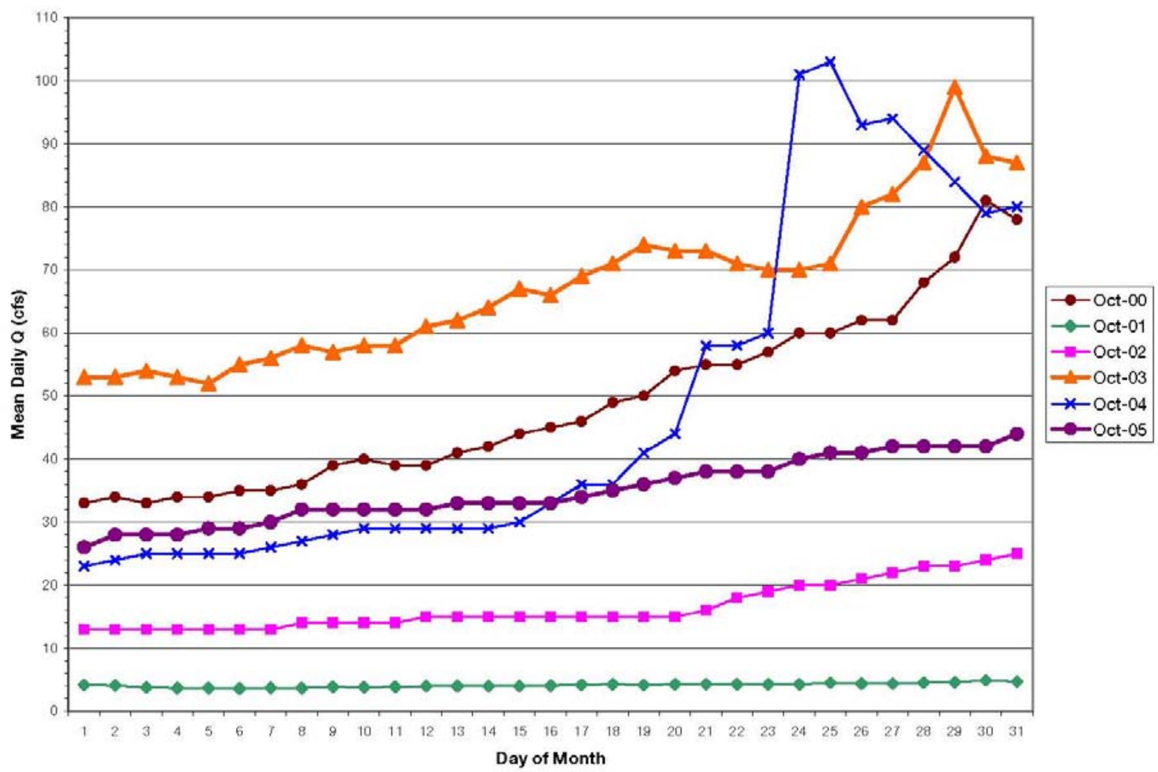
Program measures, as well as adherence to federal and state water quality standards, would help protect water quality during construction activities. As discussed above, if as part of the Program a Covered Activity performed at a single project location will disturb a total of one acre or more of land, SQRCD or the Agricultural Operator performing the project will submit a NOI to SWRCB to obtain coverage for the activity under the General Permit. The preparation of a SWPPP would be required in accordance with the General Permit. The SWPPP would include, but not be limited to, relevant measures, conditions, and obligations already described as part of the Program which would reduce the impacts of construction activities on stormwater and receiving water quality and quantity. However, even for cases where a General Permit would not be required, such as a project which would disturb less than one acre of land, the Program measures, conditions, and obligations that would protect water quality during construction activities would still be implemented.

Covered Activities that involve or are expected to involve dredge or fill, and discharge of waste, are subject to water quality certification under section 401 of the CWA and/or waste discharge requirements under the Porter-Cologne Act. SWRCB's Division of Water Rights processes section 401 water quality certifications on projects that involve water diversions (California Code of Regulations, title 23, § 3855). Chapter 4, Article 4 of the Porter-Cologne Act (California Water Code, § 13260-13274), states that persons discharging or proposing to discharge waste that could affect the quality of waters of the state (other than into a community sewer system) shall file a Report of Waste Discharge with the applicable RWQCB. For discharges directly to surface water (waters of the United States) an NPDES permit is required, which is issued under both state and federal law; for other types of discharges, such as waste discharges to land (e.g., spoils disposal and storage), erosion from soil disturbance, or discharges to waters of the state (such as isolated wetlands), Waste Discharge Requirements (WDRs) are required and are issued exclusively under state law. The WDR application process is generally the same as for CWA section 401 water quality certification, though in this case it does not matter whether the particular project is subject to federal regulation. The project proponent would contact the NCRWQCB, who would determine whether WDRs or a waiver of WDRs is required.

Also, as discussed above, it is up to the individual project proponent (e.g., the Agricultural Operators and SQRCD) to contact the relevant federal agency(s) in order to determine whether that federal agency(s) would take jurisdiction on a specific project and require a permit; if a federal permit is required then the project proponent would be required to also obtain water quality certification from NCRWQCB. In addition, the project proponent would contact NCRWQCB and determine whether an issuance or a waiver of WDRs is required.

However, with respect to controlling erosion and pollutant issues during project construction (and even project operation, in most cases), the conditions and obligations within the Incidental Take Permit (ITP) and Master List of Terms and Conditions (MLTC) are comprehensive and either meet or exceed the provisions normally stipulated in water quality certifications and WDRs. Aside from the seasonal issue discussed below, the Program measures that would protect water quality during construction activities are appropriate and sufficient with respect to federal and state water quality protection standards.

Of particular concern regarding potential erosion and pollutant impacts is the time of year when construction activities would be allowed. The risk of erosion, sediment delivery, and pollutant loading would be of most concern during the winter and spring, when significant rainfall and runoff occurs. To minimize this risk, the season for instream equipment operations and work related to structural restoration projects is limited to the period from July 1 to October 31, according to ITP General Conditions (g) and (h) (Article XIII.E.1). Much of this season typically experiences little rainfall and runoff. However, summer thunderstorm events and early winter storms could still occur during the period from July 1 to October 31, and the potential for early storms increases substantially in the second half of October (**Figure 3.2-12**). Therefore, though



SOURCE: USGS (2006b)

Scott River Watershed-Wide Permitting Program . D206063

Figure 3.2-12
October Daily Average Flows for the Scott River near Fort Jones
(Water Years 2000-2005)

the Program measures and regulatory requirements would be adequate to control potential construction-related water quality impacts through the early fall, allowing the construction period to continue through the end of October poses a potentially significant impact to water quality.

Mitigation Measures Proposed as Part of the Program

Mitigation Measure 3.2-1a: ITP General Condition (b) (Article XII.E.1) requires the immediate containment and clean-up of any fuel, lubricants, or other hazardous materials that leak or spill during a Covered Activity.

Mitigation Measure 3.2-1b: ITP Additional SQRCD and Sub-Permittee Avoidance and Minimization Obligation F. – Push-Up Dams and Obligation G. – Other Temporary Diversion Structures (Article XV) requires preparation and adoption of a set of Best Management Practices (BMP) governing the construction, operation, and removal of push-up dams and other temporary diversion structures other than push-up dams.

Mitigation Measure 3.2-1c: The MLTC includes the following conditions which will reduce the potential for construction-related impacts to water quality:

A. Water Diversions: Conditions 31, 34, and 39;

C. Instream Structures: Conditions 58-60;
E. Use of Vehicles in Wetted Portions of Streams: Conditions 65-67;
F. Pollution Control: Conditions 68-75;
G. Erosion and Sediment Control: Conditions 76-84;
I. Dewatering: Conditions 89-92, 94, 96-98; and
J. Ground-Disturbing Activities: Condition 108.

Mitigation Measures Identified in this Draft EIR

Mitigation Measure 3.2-1d: The season for instream construction activities and equipment operations shall be limited to the period from July 1 to October 15. If weather conditions permit and the stream is dry or at its lowest flow, instream construction activities and equipment operations may continue after October 15, provided a written request is made to CDFG at least five days before the proposed work period variance. Written approval from CDFG for the proposed work period variance must be received by SQRCD or Agricultural Operator prior to the start or continuation of work after October 15.

If work is performed after October 15 as provided above, SQRCD or Agricultural Operator will do all of the following:

A. Monitor the 72 hour forecast from the National Weather Service. When there is a forecast of more than 30 percent chance of rain, or at the onset of any precipitation, the work shall cease.

B. Stage erosion and sediment control materials at the work site. When there is a forecast of more than 30 percent chance of rain, or at the onset of any precipitation, implement erosion and sediment control measures.

Level of Significance after Mitigation

Implementation of Mitigation Measures 3.2-1a through 3.2-1d would substantially reduce the potential for erosion and pollution from project construction sites and, as a result, construction activity-related impacts on water quality would be reduced to a less-than-significant level.

Impact 3.2-2: Certain instream structures proposed to improve fish habitat as part of the Program would be installed within a flood hazard area and could impede or redirect flood flows (Less than Significant).

Some of the instream structures proposed as part of the Program would be installed within a 100-year flood hazard area as defined by FEMA (2004); these structures include water diversion structures (including weirs), fish screens, fish ladders, stream crossings, and structures related to channel restoration projects. Such structures, placed within the stream channel, could impede or redirect flood flows. However, water diversion structures and fish ladders installed as part of the Program would improve fish passage conditions at currently impassable (or difficult to pass) locations or alleviate existing impediments to flow (e.g., replacing dams with weirs that are lower in elevation). In doing so, they would provide for more natural passage of low to moderate flows.

These structures would be submerged during floods and exert little resistance upon flood flows. Likewise, fish screens, stream crossings, and restoration-related structures would not be expected to impede or redirect flood flows. This impact would therefore be less than significant.

Mitigation Measures

This potential impact was determined to be less than significant. No mitigation measures required.

Impact 3.2-3: Installation and operation of instream structures permitted under the Program could alter channel stability and degrade water quality by increasing turbidity downstream (Significant).

As part of the Program, CDFG would require and permit the installation and operation of instream structures under ITP Covered Activity 4 (Stream Access and Crossings), ITP Covered Activity 7 (Instream Structures), ITP Covered Activity 9 (Barrier Removal and Fish Passage Projects), and ITP Covered Activity 12 (Permit Implementation). These activities and measures are intended to either improve fish passage and habitat within the Program Area or control activities (such as cattle and vehicle crossings) that could damage streambanks or channels. Structures included in this potential impact are: boulder weirs, angular rock, bioengineered habitat structures, LWD, fish ladders, and other channel restoration or protection measures, some of which may span the width of a channel. Although the purpose of such structures is to improve habitat, as discussed below, on a reach-scale such structures have the potential to alter channel stability and influence water quality by altering sedimentation and turbidity downstream. This would be a potentially significant impact.

Instream structures may increase sediment deposition on their upstream side and induce erosion and scour immediately downstream. Lower flows (on the order of one half the bankfull discharge and lower) typically do not transport much sediment or induce channel bed and bank scour in gravel-bed streams, and therefore these flows are not a concern regarding this potential impact. The bankfull flow[10] (or range of intermediate high flows) occurs, on average, once every one to two and a half years and, over the long-term, tends to move the most sediment in a gravel-bed stream (Dunne and Leopold, 1978; Simon and Castro, 2003; Schmidt and Potyondy, 2004). Higher flow events (10-year or 25-year flood) move more sediment in a single event but with much less frequency.

If instream structures are too large or too high, they could impede the sediment transport processes that occur during larger flow events. Depending on the amount of sediment being carried into the reach of interest, these structures could alter the transport capacity of bankfull flows and cause deposition on the upstream side; if this continues to occur and the channel begins

[10] Bankfull flow is hereinafter used in the plural, “bankfull flows” or “bankfull flow conditions,” to emphasize that this term doesn’t invoke a single or static flow rate, but rather a limited range of intermediate high flows at or near the bankfull extent.

to aggrade (i.e., to cause an increase in the overall bed elevation), then this location could serve as an elevation control for the entire reach and ultimately promote further deposition upstream and exacerbate erosion immediately downstream of the structure. If the change in water surface elevation between the upstream and downstream side is great enough, these structures could induce erosion near the base and immediately downstream, as well as dissipate the flow energy to the point that the capacity for bankfull flows to move sediment from the downstream reach is notably decreased.

For structures intended specifically to improve fish habitat and passage, studies have illustrated various problems and various success rates (Frissel and Nawa, 1992; Roper et al., 1998; Niezgoda and Johnson, 2006). Roper et al. (1998) concluded that instream structures are most appropriate when used as short-term tools to improve degraded stream conditions while activities that caused the habitat degradation are simultaneously modified. The stability of instream structures would be of particular concern in the higher-order stream segments within the lowland and valley areas.

Mitigation Measures Proposed as Part of the Program

Mitigation Measure 3.2-3a: ITP Additional SQRCD and Sub-Permittee Avoidance and Minimization Obligation D.4. – Livestock and Vehicle Crossings (Article XV) requires annual monitoring of all livestock and vehicle crossings installed under the Program. If the crossing is exacerbating erosion and contributing fine sediment to the stream, SQRCD shall note that in its Annual Report and the sub-permittee shall be responsible for remediation of the problem.

Mitigation Measure 3.2-3b: MLTC Conditions 35, 41, 45, and 53 would ensure that boulder weirs are sized to resist wash-out and do not create lifts in the stream channel that exceed twelve (12) inches, and that instream structures shall be designed and implemented in accordance with CDFG’s Salmonid Stream Habitat Restoration Manual.

Mitigation Measures Identified in this Draft EIR

Mitigation Measure 3.2-3c: CDFG and SQRCD shall establish performance criteria for new and replacement instream structures including boulder weirs, angular rock for bank protection, bioengineered habitat structures, large woody debris, fish ladders, and other channel restoration or protection measures. The performance criteria shall include, but not be limited to, the following:

- Sediment deposition upstream and erosion/scour and subsequent deposition downstream of these instream structures, during bankfull flow conditions, would be avoided to the extent feasible, unless the intent of the particular structure is to facilitate such processes (e.g., gravel trapping);

- Instream structures shall not alter channel hydraulics such that the project reach can no longer move the imposed sediment load (i.e., upstream supply) with the available range of sediment-transporting flows. This criterion shall focus on the transport of bed-material load;

- Instream structures shall not lead to a permanent increase in the downstream transport of sediments that is outside the historical range of sediment flux;

- Instream structures shall be designed to withstand a given range of flows (e.g., some structures are permanent, such as fish ladders, while other structures are “semi-permanent,” such as placement of LWD). The range of flows that a particular structure will be designed to handle shall be quantified and rationalized.

Engineered structures such as fish ladders and boulder weirs designed for grade control, or for fish passage in proximity of a water diversion, require design and assessment by a qualified hydrologist, geologist, engineer, or other similarly qualified individual using methods and levels of rigor that have been established in the engineering and scientific community. Based on the assessment, if the proposed structure would fail to meet the performance criteria, then the structure shall not be installed within that particular reach.

The performance criteria shall be included in the SQRCD ITP Monitoring and Adaptive Management Plan (ITP Attachment 3) and their verification and effectiveness shall be included in the Monitoring (ITP Covered Activity 13) or Research (ITP Covered Activity 14) activities of the Program.

Level of Significance after Mitigation

Implementation of Mitigation Measures 3.2-3a through 3.2-3c would reduce the potential channel stability and water quality impacts to a less-than-significant level.

Impact 3.2-4: The Program could result in an increase in the extraction of groundwater, which could contribute to decreased baseflows and increased ambient water temperatures in the Scott River and its tributaries (Less than Significant).

Most of the surface water resources in the Program Area are fully appropriated and have been adjudicated under the Scott River Decree. Hence, an Agricultural Operator who needs additional water for irrigation may find it easier to meet that demand by using groundwater. As discussed above, the Program will not cause an increase in the use of groundwater by Agricultural Operators to *add* to the amount of water they already obtain through their surface water diversions. However, the Program could indirectly result in an increase in the use of groundwater if the measures that apply to surface water diversions included in Streambed Alteration Agreements (SAAs), the ITP, and sub-permits issued under the Program pose regulatory, economic, or other burdens that an Agricultural Operator could avoid by *substituting* all or part of its surface water diversion(s) for groundwater. The extraction of groundwater for irrigation is not a Covered Activity under the Program. However, any need for water by Agricultural Operators in addition to the amount of surface water they are entitled to divert and use would be driven by factors independent of the Program, namely increased development within the watershed and the fluctuation of commodity prices (e.g., lower commodity prices would increase the pressure to produce more or to switch to crops with higher market values but which are potentially more water intensive, such as alfalfa). The Program could also directly result in an increase in the use of groundwater because, under the Program, groundwater supplies may be used as one alternative means to satisfy stock water demands from October through December as a means of enhancing surface flows during dry conditions and during critical times of the year to improve salmonid habitat. (See ITP Mitigation Obligations of SQRCD (a)(v) (Article XIII.E.2).)

Increased use of groundwater during dry conditions in order to curb the consumptive use of surface water, as proposed by the Program, could decrease groundwater discharge into the Scott River and its tributaries. A reduction in groundwater discharge could decrease baseflow volumes and could contribute to increased water temperatures. In general, the aquifer characteristics and the interaction of groundwater and surface water within the Scott Valley are poorly understood. However, there are some general properties and relationships among groundwater and surface water that *are* understood. The permeability of alluvium within the Scott Valley can vary by orders of magnitude, and groundwater moving through these deposits is an important source of recharge to surface channels (Mack, 1958). Further, groundwater inflows are a primary driver of stream temperatures in the Scott Valley and groundwater accretion directly affects stream temperatures by addition of cold water (NCRWQCB, 2005). Utilizing groundwater instead of surface water has the potential to elevate stream temperatures (Naman, 2005). During low flow conditions, if groundwater is pumped in the proximity of a flowing stream or a subsurface channel such that subterranean flow is impacted then that groundwater extraction could result in a decrease in instream flow and, concomitantly, an increase in water temperatures in the nearby stream.

Any increase in groundwater use under the Program is expected to be low for the following reasons: 1) the proposed scale of the alternative stock watering system is small; the Program specifies the installation of two systems per year within the entire Program Area; 2) not all such systems would necessarily use groundwater, as alternative methods are also proposed; 3) groundwater irrigation tends to cost more (for well installation, piping, and power costs); and 4) the availability of groundwater resources in the Scott Valley varies greatly from location to location.

Because it is not likely that the Program would cause a substantial increase in the use of groundwater, the level of any impacts associated with such use would be low. Further, for the season in which the alternative stock watering system is proposed for use, October through December, the volume of streamflow is as much of a concern for salmonid habitat as the temperature of the water. High water temperatures are of principal concern and exert more influence on limiting salmonid habitat in the summer and early fall months. In addition, some Agricultural Operators must divert much more surface water than is needed to satisfy their stock-watering needs, because a higher volume of water is necessary to enable water to flow from the point of diversion to the point of use to accommodate for carriage loss due to varying delivery efficiencies (Black, 2008). Hence, in some cases, substitution of groundwater for surface water would result in a substantial reduction in the amount of water diverted.

As such, with respect to the impact that alternative stock watering systems may have on surface water temperatures, this potential impact is less than significant.

Mitigation Measures

This potential impact was determined to be less than significant. No mitigation measures required.

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